3D ANALYSIS OF BUILDING FRAMES AND COMPARISION WITH NUCLEAR BUILDING CODES

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By

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CANDIDATE'S DECLARATION

I hereby declare that this dissertation with title '**3D ANALYSIS OF BUILDING FRAMES AND COMPARISON WITH NUCLEAR BUILDING CODES**' contains my own work under the supervision of Dr. A.R. CHANDRASEKRAN, Professor and Shri R.N. Dubey Lecturer, Department of Earthquake Engineering, University of Roorkee, Roorkee (U.P.), India.

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ABSTRACT

Generally the building frames are analysed by Response Spectrum Method. Some of the modal combination rules used in Response Spectrum Method which has been suggested in ASCE-4-86 i.e. ASCE Standards on seismic analysis of Safety Related Nuclear Structures and Commentry on Standards for Seismic Anaysis of Safety Related Nuclear Structures are SRSS (Square Root of sum of the squares), Grouping, Ten per cent, Double sum. All these modal combination rules and CQC (Complete quadratic combination) have been evaluated in this thesis.

To account the responses from the three earthquake components calculated separately the spatial combination followed in this thesis are :

(i) SRSS

(ii) $1R_1 + 0.4R_2 + 0.4R_3$

(iii) $0.4R_1 + 1.0R_2 + 0.4\ R_3$

(iv) $0.4R_1 + 0.4R_2 + 1.0R_3$

For evaluating the above mentioned rules three buildings of different configuration have been analysed by Response Spectrum Method using above modal combination rules and by A Time-history Analysis. The results by Response Spectrum Method have been compared with the results by Time-history Analysis considering the later as standard.

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NOTATIONS

Notation	Description
Γ_j	Mode participation factor for jth mode
Δt, h	time step
λ_i	modal damping
ϵ_{ij}	Coupling coefficient in ith & jth mode
R	Response
[M]	Mass matrix
[K]	Stiffness matrix
{X}	Displacement vector
Y	Generalized coordinate
$\{\phi_j)$	Mode shape vector for mode j
[C]	Damping matrix
[T]	transformation matrix
w	frequency (rad/s)
$\ddot{u}_g$	ground acceleration
s_a	spectral acceleration in 'g'
fr	frequency (cps)
dp	modal damping
px	mode participation factor in x direction
py	mode participation factor in y direction
pz	mode participation factor in z direction
mx	modal mass in x direction
my	modal mass in y direction
mz	modal mass in z direction
cmx	cumulative modal mass in x direction
cmy	cumulative modal mass in y direction
cmz	cumulative modal mass in z direction

X horizontal axis direction

Y vertical axis

Z horizontal axis perpendicular to X & Y

Rest other notations wherever used has been defined.

Above notations having different meaning, has been explained at appropriate place.

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CHAPTER - 1

INTRODUCTION

1.1 General :

The previous decade has shown us the disaster caused by earthquakes that came in the then U.S.S.R., Iran, N.Bihar and the recent in Garhwal area (North India). The difficulty that the people has suffered, the huge wealth lost due to the earthquake has forced us to realise the fact the 'earthquake forces' must be given an important place in the design forces of any civil engineering structure irrespective of whether the structure is small dwelling house of a poor man or high rise building built for national importance.

For the structural engineers the first aim behind the aseismeic design of structure is to get the most probable forces that will be developed in the structure if earthquake hits the area in which the structure is to be made. For finding out these forces, the dynamic analysis of is necessary. The accuracy and closeness of the resulting forces depend on the method adopted for the analysis and type of structure. For simple and symmetric structure a two dimensional analysis is sufficient but the multistoreyed building, bridges and special structures like nuclear power plant etc. need 3 dimensional analysis to reach close to real values of forces and deformations.

The present architectural design practice is such which makes the building highly unsymmetrical and center of mass doesn't coincide with the center of rigidity and hence even if no torsional component is available in exciting force, the torsion will develop in building and it will cause additional stresses in the elements. A two dimensional analysis does not account for it but three dimensional analysis can account the torsional component very easily. The three dimensional analysis also takes into account the coupled translational behavior of entire structure. It can consider the three earthquake components in three mutually perpendicular directions whether dependent or independent thus 3 D. analysis is very much relevant where ever very precise seismic analysis is needed.

There are a no. of analytical alternatives available which vary in approach i.e. empirical, semi-empirical, mathematical complexity, time taken for solution, accuracy of results etc.

1.2 THE TIME-HISTORY METHOD :

The time history method for seismic analysis is the solution of a no. of simultaneous second order differential equations of motion (1.2-1). If the earthquake ground motion is known, this method gives most realistic values. Since it gives the temporal information so this method of analysis becomes very necessary when the design of secondary responding equipment eq. piping, machinery etc. on upper floors of a structure is required. Since it accounts for intermodal phasings so it gives precise results for any type of structures whether symmetric/unsymmetric .

Time history analysis may be done by direct integration or by mode superposition time integration for linear or non linear cases. The motion of equation is -

$$[M]\,[\{\ddot{x}\} + \{\ddot{U}_g\}] + [C]\,\{\dot{x}\} + [K]\,\{x\} = \{o\} \qquad \ldots.(1.2\text{-}1)$$

1.2.1 Direct Integration :

In this approach the response is evaluated in a direct step by - step integration procedure No. decoupling is necessary and damping does not have to be proportional to mass or stiffness.

Response is evaluated for successive short time increments Δt, and dynamic equilibrium is established at the beginning and end of each interval.

1.2.2 Mode Superposition :

The equation of motion (1.2.1 -1) can be solved by mode superposition method if the equation of motion can be decoupled using the transformation

$$\{X\} = [\phi]\ \{Y\} \qquad \ldots.(1.2.2\ \text{-}1)$$

where

$\{X\}$ = displacement vector

$[\phi]$ = mode shape matrix, normalized as

$[\phi]^T\ [M]\ \{\phi] = [1]\ (m \times m)$

$[Y]$ = generalized co-ordinate vector $(m \times 1)$

m = no. of modes considered

In direct integration method , if the mass matrix is diagonal and no damping is asssumed, the number of operations for one time step are somewhat larger than 2nmk where n and mk are the order and half-bandwidth of the stiffness matrix considered respectively. If damping matrix is included and consistent mass matrix is used in the analysis and additional number of operations proportional to nmx is required per time step.

Therefore, neglecting the operations for the initial calculations total number of about $\alpha n m_k s$ operations are required in the complete integration, where α depends on the characteristic of the matrices used, $\alpha \geq 2$ and s is the number of time step. Thus if m_k is reduced the no. of calculations reduces in same proportion. In fact there is a limit beyond which m_k can not be reduced and so due to huge computation involved, the direct integration method is effective when the response for a relatively short duration is required and, for larger duration an alternative method i.e. mode superposition method is adopted.

In mode superposition method the final response say displacement x is given by

$$X(t) = \sum^{m} \phi i \quad Yi(t) \qquad \text{....(1.2.2 - 2)}$$

Where m is no. of modes considered and the transformation (1.2.2-1) reduces the 'n' coupled equations of motions into 'm' no. of uncoupled equation of motion for each mode. Thus the no. of calculations in each time steps is considerably reduced, but at the same time solution of eigenvalues and eigenvevtors i.e. the free vibration mode shapes of the idealized structure is required. However, it is also a fact that the effectiveness of mode superposition depends on the number of modes that must be included in the analysis. In general, the structure considered and the spatial distribution and frequency content of the loading determine the number of modes to be used. For earthquake loading in some cases only the 10 lowest modes need be considered, although the order of system 'n' may be larger than 1000.

One important aspect should be mentioned in this context. What is really aimed is to obtain a good approximation to the actual exact repose of the structure under consideration. In the case of stiffness matrix method or finite element analysis upper bounds to the 'exact' frequencies of the actual structure are obtained. In general this method approximate the lowest exact frequencies best, and little or no accuracy can be expected in approximating the higher frequencies and mode shapes. Therefore there is usually little justification for including the response in the mode shape corresponding to the high frequencies in the analysis.

Thus it appears that mode superposition procedure has an inherent advantage over direct integration in that the response corresponding to the higher, probably inaccurate frequencies of the idealized system is not included in the analysis. Even if these higher frequencies are correct their response is little and not important. So exclusion of higher frequencies will not affect the accuracy of the solution.

A suitable stable numerical method for time integration should be adopted and an appropriate integration time step Δt should be chosen. In the present dissertation Newmark Method has been adopted with Δt equal to 0.005 seconds.

As discussed above the choice between mode superposition analysis and direct integration is merely one of numerical effectiveness. The solution obtained using either procedure are identical [if the same time integration methods are used in direct integration and in mode superposition method,] same numerical errors and the round off error in the computer are present

1.3 RESPONSE SPECTRUM METHOD :

In modern earthquake engineering the response spectrum method has emerged as the most commonly used method of analysis. The primary reason for this popularity is the fact that it provides the designer with a rational and simple basis for specifying the earthquake loading. Another reason often sited is that the method is computationally economical. A major part of the effort, which is common in mode superposition time integration and response spectrum method is the solute of the eigenvalue problem. In fact if the objective is to evaluate the response of a

structure subjected to known earthquake ground motion, there should not be any question about using a standard time - domain analysis. It is when the designing a structure for a potential future earthquake is required that the response spectrum method is much more relevant.

The lack of temporal information of the response of the structure seems to be its great limitation and so the design of secondary responding equipment (piping, machinery etc. on upper floors of a structure) seem to be impossible with this method.

Much progress has been made in this field so far. Lack of temporal information in the response spectrum method no longer appears to be a handicap.Rational rules are now available to combine responses from various modes and from three components of earthquake motion. These rules account for the physics of the problem and can be further justified in the same spirit as the design spectrum itself, as a representation of expected response values in an uncertain world. Response of secondary system can now be evaluated using efficient modal synthesis techniques in conjunction with the response spectrum method. Alternatively, the secondary spectrum, or the instructure response spectrum can be evaluated by applying similar model synthesis techniques to the secondary single degree of freedom oscillator coupled to the primary system. These new techniques directly use the design response spectrum at the base of the primary structure as seismic input and account for the effects of mass interaction (between the equipment and the structure) and of multiple support input into the secondary system. In doing so it is no longer necessary to convert the design response spectrum into a 'compatible motion history or a power spectral density function.

In a multi degree of freedom system the maximum response value in individual modes are determined and by model combination rules, these values are combined to give the most probable maximum values. The modal combination rules i.e. SRSS, CQC, GROUPING 10%., DOUBLE SUM etc. are based partly on the physic of the problem, that is an deterministic concepts, and partly on the random vibration modeling of the phenomenon. The model combination technique can be viewed as tools for giving approximate values of the deterministic maximum response values. It is in this spirit that the response spectrum analysis results shall be compared with the corresponding time-history maxima for an earthquake considering the latter as standard. A rule which models the physics well is likely to give results which are reasonably close to those obtained using the time-history analysis.

1.4 Objective and scope of study :-

The objectives of the present thesis are

(1) Three dimensional Dynamic Analysis of building frames by Mode Superposition Time Integration for given dependent time-histories of ground acceleration in three mutually perpendicular directions coinciding with the axes of building frame and to obtain the time-domain maximum for deformations of different modes and forces in different structural elements of the building frame.

(2) The calculation of most probable maximum values of deformation of different nodes and forces in different element of the same buildings analysed by time-history method for the response spectrum corresponding to the given time-history, acting in three mutually perpendicular directions which coincide the three axes of building frame. The modal combination techniques chosen for response spectrum techniques are

(a) SRSS (square root of sum of the squares)

(b) CQC (complete quadratic combination)

(c) Grouping

(d) 10%

(e) Double sum.

(3) Comparison of the spatially combined results obtained from response spectrum method i.e. different modal combination technique with that obtained from time-history analysis considering the later as standard.

In order to get the above objectives mentioned as 1, to 3, three typical buildings have been chosen without shear wall. In the above analysis soil structure iteration has not been taken into account. The response spectra corresponding to given time history is shown in figure(1). The same response spectra value is used multiplied by 0.5 in vertical direction. The results obtained due to earthquake in each three directions are combined by spatial combination rules before comparing with the results obtained by time history analysis.

4. The number of modes considered in the R.S.T. and Mode Superposition time history analysis depends on total modal mass. Sufficient number of modes have been taken so that total modal mass is equal or greater than 90%.

CHAPTER - 2

REVIEW OF LITERATURE AND DIFFERENT METHODS

2.1 General :

The seismic analysis has an important place in the design of structures related to nuclear power plants. The ASCE standards (ASCE 4-86) on seismic analysis of safety related nuclear structures gives proper guideline for designing such important structures.

This standard provides requirements for performing analysis to obtain design information which will lead to the reliability of structures under a severe earthquake. The main aim of this standard is to provide rules and analysis parameters that are expected to produce seismic design response that have about 90% chance of not being exceeded for a given design earthquake, assuming that the input response spectrum is specified at the mean plus one standard deviation level. Specification of input motions, response spectra and input motion time histories and analysis standards for different type of special structures are given in this standard.

2.2 Modelling of Structures :

The seismic response of a structure is determined by preparing a mathematical model of the structure and calculating the response of the model to the prescribed seismic input. The torsional effect due to eccentricity between the centre of mass and centre of rigidity should be considered. The possibility of accidental torsion should also be considered.

When significant coupling exists between horizontal and vertical structural responses, one combined analytical model (a three-dimensional model) should be used for the seismic response analysis otherwise, a separate analytical models for horizontal and vertical excitations may be used.

The need for 3 D. model of structure is evident from the result of experiments and analysis of 40 story framed tube building done by Reddy, D.P. et.al. (1973). The static and dynamic response were compared with 3 D. and 2D. analysis based on UBC. Based on their study it was found that building showed 3 D. behavior even if it was symmetric about two centre lines of building. The conventional 2 D frame analysis results in significant error for tall buildings.

2.3 Time History Analysis :

As per discussions made in article 1.2.1 and 1.2.2. mode superposition time-integration scheme seems to be most suitable for the time-history analysis if mass matrix is diagonal and damping can be assumed to ' rayleigh damping '.

In the implicit method of integration N.M. Newmark (1959) proposed the unconditionally stable scheme, the constant average acceleration method in which $\alpha = \frac{1}{4}$, and $\delta = \frac{1}{2}$, when the following assumptions were made

$$\dot{Y}_{t+\Delta t} = \dot{Y}_t + [(1-\delta)\ddot{y}_t + \delta\ddot{y}_{t+\Delta t}]\Delta t \qquad \text{....(2.3-1)}$$

$$Y_{t+\Delta t} = Y_t + \dot{Y}_t\Delta t + [(\frac{1}{2} - \alpha)\ddot{Y}_t + \alpha\ddot{Y}_{t+\Delta t}\} \Delta t^2 \qquad \text{....(2.3-2)}$$

and equilibrium at time t + Δt is considered

$$M\ddot{Y}_{t+\Delta t} + C\dot{Y}_{t+\Delta t} + Ky_{t+\Delta t} = R_{t+\Delta t} \quad \ldots.(2.3\text{-}3)$$

where y = deformation, t = time, Δt = time step; M = Mass, C = damping K = stiffness, R = force). The solutions by different implicit and explicit scheme were compared by Bathe & Wilson and the solution of Newmark's method was found close to the exact solution.

ASCE - 4-86 suggests the maximum interval of time step for different numerical integration scheme. It suggests maximum time step size of $\frac{1}{10}$ of shortest period of interest for Newmark method in modal superposition time integration method.

The lowest time period for earthquake analysis is 0.033 seconds so the time step size of 0.0033 may be sufficient but a value of 0.005 is said to be quite satisfactory for the seismic analysis.

2.4 RESPONSE SPECTRA METHOD :

Use of response spectra for the design of earthquake resistant structures has been established as an inexpensive and reliable alternative to multiple time history analysis. In fact design engineers may prefer the response spectrum technique, not only because of its simplicity and low computational cost, but also because it lends itself to a more general description of the required strength in a particular seismic environment.

One of the difficulties and occasionally a source of criticism for the response spectrum method is the superposition of modal maxima, not all of which will occur at the same time.

Extension of the method to deal with multicomponent excitation adds one more unknown to the problem because now the combination of directional responses must also be considered. Most of the experience with the response spectrum technique comes from analysis in which only one motion component has been used. In this case, modal combination method based on probability considerations, provide reasonable engineering estimates of maximum response for a large class of real earthquakes and as a result, they have been widely accepted and routinely used in design; when multicomponent excitation are to be considered, the question of statistical dependence between motion components arises. Design recommendations for offshore platforms (API-RP2A) and the Regulatory Guide 1.92 of the U.S.N.R. recommend that the three spatial (or directional) responses be combined by SRSS. The tentative ATC-3 provisions on the other hand, recommend the maximum of the three components plus 30% of other two combination rule. Both these methods can be derived from probability considerations under the assumption of statistical independence between motion components or less restrictively between the corresponding structural response. It appears, however, that very little has been done to validate these rules using actual earthquake accelerograms and realistic structural models. Moreever, the assumption of statistical independence between motion components may not be always justified. Motions with a strong unidirectional character, for example such as those recorded on hard ground at small epicentral distances and from shallow earthquakes, constitute a class of excitations whose components can be expected to exhibit appreciable correlations.

A third type of uncertainty is associated with the design equations that involve more than one component of stress, as for example the AISC equations for combined axial compression and bending. For a space frame structure, the force quantities in such equations will generally peak at different times. The response spectrum technique, however, does not provide any information that would allow estimates of maximum combined effects. Thus, conservative results may be expected if, as is typical in practice, the peak (response spectrum) values of the force and moments in a section are used without any reduction.

2.4.1 Different Modal Combination Rules :

1 S.R.S.S. (square root of sum of square) :

Originally proposed by Goodman (1953), on the basis of probabilistic theory, it gives the most probable values of response. It gives lower bound to the response.

The study carried out by H.C Merchant and D.E. Hudson (1962) suggests that this method is applicable to limited type of structures and earthquakes excitation For another situation other methods should be searched for ASCE-4-86 suggests its use The S.R.S.S. combination rule is

$$R_i = \left[\sum_{j=1}^{N} (R_{ij})^2 \right]^{1/2}$$

R_i = response of i the degree of freedom

j = no. of mode (from 1 to N)

2 C.Q.C. (Complete quadratic combination) :

Proposed by E.L. Wilson, A. Der Kiurghian and E.P. Baya in (1981) it gives better result than SRSS because of cross correlation coefficient ρ_{jk}. If the modal damping of two modes are same, then value of $\rho_{jk}=1$ and the response obtained by CQC and 'Double sum ' discussed later are same.

The CQC method is

$$R_i = \sqrt{\sum_{j=1}^{N} \sum_{k=1}^{N} \rho_{jk} R_{ij} R_{ik}}$$

cross correlation

$$\rho_{jk} = \frac{8 \sqrt{\eta_j \eta_k} \left(\eta_j + \frac{wk}{wj} \eta_j\right) \left(\frac{wk}{wj}\right)^{3/2}}{\left[\left(1 - \left(\frac{wk}{wj}\right)^2\right) + 4\eta_j \eta_k \frac{wk}{wj} \left(1 + \left(\frac{wk}{wj}\right)^2\right) + 4 \left(\eta_j^2 + \eta_k^2\right) \left(\frac{wk}{wj}\right)^2\right]}$$

η_j & η_k are modal damping ratios in mode j & K respectively

when $\frac{wj}{wk} < \frac{0.2}{\eta_j + \eta_k}$, $\rho_{jk} \approx 0.1$ and it may be neglected.

ASCE 4-86 has not mentioned its use.

CLOSELY SPACED MODES :

Modes are called closely spaced if natural frequencies do not differ by 10% i.e. if the criteria $\frac{wk - wj}{wj} \leq 0.1$ is satisfied, both modes are considered closely spaced. Where w_k and w_j are natural frequency of modes k and j respectively.

For closely spaced modes a no. of modal combination methods are used, some of them are as follows.

3. Grouping Method :

It is an improvement over the SRSS to account for closely spaced modes. In this method, modes are divided into groups that include all modes having frequencies lying between the lowest frequency in the group and a frequency 10% higher. For each group the representative value of the response is taken as the sum of the absolute values of modal maxima belonging to the group. The maximum response is then obtained as the SRSS of the representative group values. This rule is

$$R_i = \left[\sum_{j=1}^{N} R_{ij}^2 + \sum_{k=1}^{nc} \sum_{l=p}^{q} \sum_{M=p}^{q} \left| R_{ilk} \quad R_{imk} \right| \right]_{l \neq m}^{1/2}$$

where

n_c = no of closely spaced group

p = number of mode where grouping starts

q = number of mode where grouping ends

$R_{ilk,}$ R_{imk}- modal response within 'k'group for 'ith' degree of freedom in mode l and m respectively.

This method is suggested in ASCE 4-86.

4 **Ten percent method (10% method)**. It is an another improved method like grouping method over SRSS rule in case of closely spaced modes. It has at least as many terms as in 'grouping' and it gives same or a more conservative result. Mathematically it is expressed as

$$R_i = \left[\sum_{j=1}^{N} R_{ij}^2 + 2 \quad R_{ik} R_{il} \right]_{K \neq 1}^{1/2}$$

Second summation is carried out for all those modes which satisfy

$$\left.(i)\ W_k < W_l < 0.1\ W_k \right\}$$

where (ii) $1 < K < L < n$

5. Double sum method- the exceptions for the SRSS combination rule aries when the responses to be combined are from modes with closely spaced frequencies. If frequencies and dampings of two modes are identical, the maximum values in the two modes do occur simultaneously and they should be combined algebraically. If combination equation in time domain is

$$R(t) = \sum_{i}^{n} R_i\ (t) \qquad 2.4.1\text{-}5.1$$

Defining the standard deviation of the response as

$$\sigma^2 = \frac{1}{td} \int_0^{td} R^2\ (t)\ dt = \sigma_i^2 = \frac{1}{td} \int_0^{td} R_i^2\ (t)\ dt \qquad 2.4.1.5.2$$

where t_d = duration of motion. Considering the earthquake to be a stationary ergodic process, the maximum response may be given like

$$R = \eta\sigma\ ; \qquad R_i = n_i\ \sigma_i \qquad 2.4.\ 1.5.3$$

Since prime interest is modal response with close frequencies,simplifying assumption . $\eta = \eta_i$ can be made for all values of i, thus

$$\sigma^2 = \sum_i \sigma_i^{\ 2} + \sum_i \sum_{j=i} \varepsilon_{ij}\ \sigma_i \sigma_j$$

where ε_{ij} is modal correlation coefficient given by

$$\epsilon_{ij} = \frac{\frac{1}{td}\int_{o}^{td} R_i(t)\, R_1\,(t)\, dt}{\sigma_i \sigma_j}$$

and alternative from of equation 2.4.1..5.3 is as

$$R^2 = \sum_i \sum_j \epsilon_{ij} R_i R_j \qquad 2.4.1.5.4$$

Rosenblueth and Elorduy assumed the earthquake ground motion to be a finite segment of white noise, and assumed the response to be damped periodic of the form $e^{-\zeta\omega t} \sin \omega_D t$. Based on his work correlation coefficient can be written as

$$\epsilon_{ij} = \left[1 + (\frac{\omega_{Di} - \omega_{Dj}}{\zeta_j\, \omega_i + \zeta'_j\, \omega_j})^2\right]^{-1}$$

Where ω_i and w_j are circular frequencies of the two modes in rad/s, ω_{Di} and ω_{Di} are corresponding damped frequencies. ζ'_i & ζ'_j are equivalent damping ratios which account for the reduction in the response due to finite nature of white noise.

$$\zeta'_i = \zeta_i + \frac{2}{\omega_i s}$$

$$\zeta'_j = \zeta_j + \frac{2}{\omega_j s}$$

where S is the effective durations of the white noise segment.

As suggested by Prof. A.K. Gupta in his book Response Spectrum Method, no absolute sign should be included in equation 2.4.1..5.4, but still A.S.C.E. 4-86, has given the rule of Double Sum Method as

$$R_i = \left[\sum_{j=1}^{N} \sum_{k=1}^{N} \epsilon_{jk} \left| R_{ij} = R_{ik} \right| \right]^{1/2}$$

$$\epsilon_{ij} = \left[1 + \left\{ \frac{w_j' - w_k'}{\beta_j' w_j + \beta_k' w_k} \right\}^2 \right]^{-1}$$

$$w_k' = w_k \left(1-\beta_k^2\right)^{1/2}$$

where , β_k = modal damping of K_{th} mode, ω_k= frequency of K_{th} mode(rad/s), $\beta_k' = \beta_k + \frac{2}{t_d \omega_k}$

Since no recommendation has been made for t_d so the value of t_d shall be taken as duration of earthquake 38 s in the present thesis. The rule as suggested in A.S.C.e. - 4-86 shall be used instead of that suggested by Prof. A.K. Gupta.

2.5 Spatial combination of responses

When response from the three earthquake components are calculated separately, the combined earthquake induced response are obtained by a number of combination rules. Some of them as suggested by ASCE-4-86 are discussed here.

2.5.1 Combination of components for time history analysis

In a linear time history analysis, the analysis may be performed separately for each of the three components of earthquake motion, or one analysis may be performed by applying all three components simultaneously, if the three components of earthquake motion are statistically independent.

When linear time history analysis are performed separately for each component, the combined response for all three components may be obtained using the SRSS rule to combine the maximum responses from each earthquake component.

$$R_i = \pm \sqrt{\sum_{j=1}^{3} (R_{ij})^2} \qquad \ldots \quad 2.5.1.1$$

R_i = response in ith degree of freedom

R_{ij} = response in ith degree of freedom due to earthquake in jth direction.

If the three components of earthquake motion are statistically independent in a linear analysis, time history responses may be obtained individually for each of the three independent components and combined algebraically at each time step.

$$R_i(t) = \sum_{j=1}^{3} R_{ij}(t) \qquad 2.5.1.2$$

2.5.2 Spatial combination rules for response spectrum method

There are following four methods suggested in ASCE-4-86 for combining responses from three earthquake components.

(1) SRSS (Square root of the sum of the square) - This rule is mathematically represented as

$$R_i = \sqrt{\sum_{j=1}^{3} R_{ij}^2} \qquad 2.5.2.1$$

where, R_i = combined response of ith degree of freedom

R_{ij} =Response of ith degree of freedom due to earthquake component in jth direction (j = 1,2,3), i.e. two horizontal and one vertical direction.

(2) Other alternative methods for combining the response, due to earthquake in three directions are based on assumption that, when the maximum response from one component occurs, the response from the other two components are 40% of the maximum. In this method, all possible combinations of the three components, R_1, R_2, R_3 including variation in sign (+, -), should be considered, i.e.

(B) $R_i = \pm [R_{i1} + 0.4\ R_{i2} + 0.4\ R_{i3}]$ 2.5.2.2 (b)

(C) $R_i = \pm [0.4\ R_{i1} + 1.0\ R_{12} + 0.4\ R_{i3}]$ 2.5.2.2 (c)

(D) $R_i = \pm [0.4\ R_{i1} + 0.4\ R_{i2} + 1.0\ R_{i3}]$ 2.5.2.2 (d)

As mentioned earlier the modal combination rules SRSS, grouping, 10%, Double sum as recommended by ASCE-4-86 has been chosen for the evaluation of its accuracy with respect to time history analysis results, considering the later as standard. In addition to, the four modal combination rules mentioned above, CQC has also been chosen since it is among the recent modal combination rules and it applies to closely spaced modes as well as non-closely spaced modes.

For the spatial combination the SRSS has been chosen for time-history method and for response spectra method the spatial combination rules chosen are SRSS, and all combination rules mentioned as B, C, D above.

Similar comparisons were made by Mr. Trivedi J.K. in his dissertation Analysis of Multistorey Building using 3-D Beam Element. His comparison among the modal combination rules shows that DABS (Double Absolute Sum Method) envelopes the response given by CQC, Double Sum etc.

CHAPTER - 3

THREE DIMENSIONAL ANALYSIS OF BUILDING FRAMES

3.1 General

The stiffness matrix method for three dimension analysis of building frames is a compact and powerful method. It is suitable for digital computer too. In the 3D analysis each node has six degrees of freedom i.e. three translational along the x, y, z axes and three rotational about these axes. Consequently, a beam element of a space frame has for its two joints a total of 12 degrees of freedom , hence the resulting element. Stiffness matrix will be of dimension 12 x 12.

The 3 dimensional analysis of frames results in a comparatively longer computer program in general requiring substantially more input data, and the availability of a computer with larger storage memory. However, except for size, the analysis gives far precise result as compared to 2 dimensional analysis for unsymmetrical buildings, tall structures and special structures where 2 dimensional idealization is not justified.

3.2 STATIC ANALYSIS :

Static analysis is done for dead load due to self weight of structure or any additional load of permanent nature and for live load on the structure. Equivalent wind load can also be applied at nodes like that due to dead loads and live loads.

3.2.1 Assumptions :

The following assumptions has been made in this method.

(a) All column and beams of space frame can be replaced by line members oriented along the centroidal axis of the original member.

(b) The line members have same properties of original member i.e length, inclination, elasticity, moment of inertia, damping, poisson's ratio, cross sectional area etc.

(c) The joint where two members meet are rigid and infinitesimal in size.

(d) The structural material is homogeneous and isotropic.

(e) The deformation of structure bears linear relationship with the load causing this deformation.

(f) The material remains in elastic limit.

(g) The reinforced concrete structures element is modeled as uncracked sections.

(h) The base support is taken as fixed and does not allow any type of deformation.

(i) The total deformation of a node can be represented completely by six degrees of freedom, i.e. three translational along three mutually perpendicular axis and three rotational about these three axis.

(j) Out the three local axes, one axes that is x axis coincide with centroidal axis of member.

3.3.2 Element stiffness matrix :

Figure -3 shows the beam element of space frame with its 12 degrees of freedom numbered consecutively. The double arrow indicates rotational degree of freedom where as single arrow shows translational.

By solving the following equations

(a) $F_1 = -\left(\frac{du}{dx} - \alpha T_m\right) EA$ For axial

(b) $F_4 = -GJ\left(\frac{d\theta}{dx}\right)$ For rotational

(c) $EI_z \frac{d^2v}{dx^2} = F_2 x - F_6 - M_{Tz}$ For shear & bending

where $M_{Tz} = \int_A \alpha ETydA$

a number of equation are obtained. They are as follows respectively.

$F_1 = \frac{EA}{L} u_1$ neglecting T_m = temp difference

$F_4 = \frac{GJ}{L} u_4$

$F_2 = \frac{12EI_z}{(1 + \phi y) L^3} u_2$ where $\phi y = \left(\frac{12EI_z}{GA_{sy} L^2}\right)$

$F_6 = \left(\frac{4 + \phi y}{1 + \phi y}\right) \frac{EI_z}{L}$

where,

u = translational displacement in direction 1

v = translational displacement in direction 2

θ = rotation

E = Modulus of Elasticity

L = Length

I_z = Moment of inertia about axes z-z

G = Modulus of rigidity

α = thermal coefficient of expansion

T = temperature

F = force

Thus defining stiffness coefficient k_{ij} as restoring force in direction 'i' due to unit displacement in direction 'j' and at other direction no displacements following coefficients are obtained

$$k_{1,1} = \frac{EA}{L}$$

$$K_{4,4} = \frac{GJ}{L}$$

$$K2,2 = \frac{12EI_z}{(1 + \phi y)\ L^3}$$

$$K_{6,6} = \left(\frac{4 + \phi y}{1 + \phi y}\right) \frac{EI}{L}$$

Similarity solving equation relating deformations and forces in all directions at two nodes the stiffness matrix for one element of size 12 x 12 is obtained. Table - 1 shows the stiffness matrix of one beam element in local direction.

3.2.3 Transformation matrix :

Since the direction of local co-ordinate axes and the direction of Global co-ordinate axes do not coincide so deformations and forces in local co-ordinate system are multiplied by a matrix '[T]' to bring these deformations and forces corresponding to Global axes for the whole system. This multiplying matrix '[T]' is called transformation matrix.

Figure - 4, shows the local and Global co-ordinate system.

Table - 3, shows the transformation matrix.

3.2.4 Static Equations and Its Solution :

Local Element stiffness matrix $[k]_{12x12}$ is multiplied by transformation matrix $[T]_{12x12}$ to convert into Global stiffness matrix $[K]_{12x12}$ and this is assembled together to form Global stiffness matrix for whole system $[K]_{nxn}$ where n is degrees of freedom (total). Denoting force at node as {F} in global co-ordination system and deformation vector {x} in Global direction.

$$[K]_{12 \times 12} = [T]^T_{12 \times 12} [K]_{12 \times 12} [T]_{12 \times 12} \quad ...3.2.4.1$$

The Global stiffness matrix $[K]_{nxn}$, Force vector $[F]_{nx1}$ and deformation vector $\{X\}_{nx1}$ are related as

$$[K]_{nxn} \{X\}_{nx1} = \{F\}_{nx1} \quad 3.2.4.2$$

Since right hand side of equation 3.2.4.2 is known, the deformation vector $\{X\}_{nx1}$ can be found out by solution of equation

3.2.4.2. The solution can be achieved by a no of methods available but Choleskey's forward backward substitution method is very economical.

After finding $\{X\}_{nx1}$, the relative deformation in each direction of an element is known and thus $\{X\}_{12x1}$ which indicates deformation of an element in global direction is known. Thus $\{X_l\}_{12x1}$ in local coordinate is achieved as

$$\{x_l\}_{12x1} = [T]^T \{X\}_{12x1} \qquad \ldots\ 3.2.4.3$$

and element forces {f} are calculated by following equation

$$\{f\}_{12x1} = [K]_{12x1} \; \{X\}_{12x1} \qquad \ldots\ 3.2.4.4$$

3.3 DYNAMIC ANALYSIS :

Dynamic analysis has been done by two methods namely mode superposition time integration and Response spectrum method.

3.3.1 Time history Analysis :

The response of a multi degree of freedom linear system subjected to seismic excitation is represented by following differential equation of motion.

$$[M]\left[\{x\} + \ddot{U}_g\}\right] + [c]\;\{\dot{x}\} + [K]\;\{x\} = 0 \qquad \ldots\ 3.3.1.1$$

where

[M] = mass matrix (n x n)

[C] = damping matrix (nxn)

[K] = stiffness matrix (nxn)

{X} = Column vector of relative displacements (nx1)

$\{\dot{X}\}$ = Column vector of relative velocities (nx1)

$\{\ddot{X}\}$ = column vector of relative accelerations (nx1)

n = number of dynamic degrees of freedom

$\{\ddot{U}_g\}$ = column vector of ground accelerations (nx1)

3.3.2 Assumptions involved in above dynamic analysis method are

(a) All assumptions mentioned in article 3.2.1 are valid in the dynamic case too.

(b) The inertial mass properties of a structure may be modeled by assuming that the structural mass and associated rotational inertia are descritized and lumped at node points of the model. Alternatively, the consistent mass formulation may be used.

In present thesis the structural mass is lumped so that the total mass, as well a the location of the center of gravity is preserved, both for the total structure and for any of its major components that respond in the direction of motion. The inertial effect associated with any rotational degree of freedom has been assumed to be zero.

The element mass matrix in local co-ordinate is shown in table 4.

(c) Damping for the R.C.C. structure has been taken as 5% as per recommendation made in ASCE-4-86.

3.3.3 Transformation of coordinates :

The transformation matrix is same as discussed in article 3.2.3. The conversion of local mass matrix, local stiffness matrix, and local damping matrix is done by following transformation equations.

$$[M]_{12x12} = [T]^T_{12x12} [m]_{12x12} \times [T]_{12x12} \qquad 3.3.3.1$$

$$[C]_{12x12} = [T]^T_{12x12} [c]_{12x12} \times [T]_{12x12} \qquad 3.3.3.2$$

$$[K]_{12x12} =K [T]^T_{12x12} [k]_{12x12} \times [T]_{12x12} \qquad 3.3.3.3$$

where $[T]_{12x12}$ is transformation matrix for element under consideration.

$[m]_{12x12}$ mass matrix for element under consideration in local co-ordinate system.

$[c]_{12x12}$ damping matrix in local coordinate for element under consideration.

$[M]_{12x12}$ mass matrix in global coordinate

$[C]_{12x12}$ damping matrix in global coordinate

3.3.4 Assembling of matrices :

The assembly of element damping matrix, mass matrix and stiffness matrix in global coordinate system is done with respect to node numbering of element under consideration and corresponding degrees of freedom. Mathematically.

$$[K]_{nxn} = \sum_{i=1}^{N} [K]^i_{12x12}$$

$$[C]_{nxn} = \sum_{i=1}^{N} [C]^i_{12x12}$$

$$[M]_{nxn} = \sum_{i=1}^{N} [M]^{i}_{12x12}$$

where $[K]_{nxn}$, $[C]_{nxn}$m $[M]_{nxn}$ are matrices stiffness, damping, and mass for whole system whereas $[K]^{i}_{12x12}$, $[C]^{i}_{12x12}$, $[M]^{i}_{12x12}$ are respective matrices for ith element in global co-ordinates.

3.3.5 Free Vibration characteristics :

The frequently considered eigenproblem in the seismic analysis is the generalized eigenproblem.

$$[K]\{\phi\} = \{\lambda\}[M][\phi]$$

where $[K]$ = assembled stiffness matrix nxn

$[M]$ = assembled mass matrix nxn

$[\phi]$ = $[\phi_1, \phi_2, \ldots \phi_p]_{nxp}$ where ϕ_i = eigen vector for mode 'i'

$\{\lambda\}$ = $[\lambda_1. \lambda_2 \ldots \lambda_p$ where $\lambda_i = w_i^2$

where w_i = natural frequency in mode 'i' in rad/sec

A number of methods are available for the solution of eigenproblem. In the present thesis the computer program developed by Prof. A.R. Chandrasekran has been used.

3.3.6 No. of modes to be considered :

ASCE-4-86 suggests (a) The number of modes included in the analysis by response spectrum technique and modal superposition time integration should be sufficient to ensure that inclusion of all remaining modes does not result in more than a 10% increase in total response. The method based on missing modal mass in which the cutoff frequency is determined so that the total modal mass considered in the response calculation is at least 90% of the total system mass.

(b) In lieu of above, it may be sufficient to include all modes having frequencies less than the ZPA frequency (i.e. 33 Hz.)

In the present thesis both criteria have been taken i.e. modes up to 33 Hz frequency or upto modal mass equal to 90% in all three directions of earthquake have been considered.

3.3.6.1 Modal mass for mode 'j' is defined as

$$\text{Modal mass} = \frac{\left(\sum_{i=1}^{n} m_i \ \phi_{ij}\right)^2}{\sum_{i=1}^{n} m_i \ \phi_{ij}^2}$$

n = No. of degrees of freedom

m_i = mass in ith degree of freedom direction

3.3.7 Modal superposition time history method :

This method may be used when equation of motion 3.3.1.1 may be decoupled using the transformation

$$\{X\}_{nx1} = [\phi]_{nxm}\{Y\}_{mx1} \qquad \ldots \qquad 3.3.7.1$$

where $\{X\}_{nx1}$ = vector of relative displacement

n is total degree of freedom

$[\phi]_{nxm}$ mode shape matrix containing

'm' mode shape vector

$\{Y\}_{mx1}$ = vector of normal, or generalized coordinate

The uncoupled equation of motion for each mode shall be transformed to a single degree of freedom system for mode;

$$\ddot{y}_j + 2\lambda_j\omega_j\dot{Y}_j + \omega^2_j Y_j = -\Gamma_j \ddot{U}_j \qquad 3.3.7.2$$

where Γ_j = mode participation factor for mode 'j'

$$= \frac{\{\phi_j\}^T_{1xn} [M]_{nxn} \{1\}_{nx1}}{\{\phi_j\}^T_{1xn} [M]_{nxn} \{\phi_j\}_{nx1}}$$

λ_j = modal damping for mode 'j'

$$= \frac{\{\phi_j\}^T_{1xn}\left[\sum_{i=1}^{N} [\lambda K]_i\right]_{nxn}\{\phi_j\}_{nx1}}{\omega_j^2}$$

where $[\lambda K]_i$ = stiffness matrix for the ith element or subsystem in the global coordinate system, scaled by the modal damping ratio of the ith element.

w_j = natural frequency (rad/sec) of jth mode

Y_j = generalized coordinate for jth mode

$\ddot{U}_g$ = ground acceleration which is a function of time

3.3.7.1 Numerical integration

Equation 3.3.7.2 is integrated numerically at a particular time step ' h' which has been taken as 0.005 second in the present thesis. The numerical integration method used is Newmarks's constant average acceleration method as discussed in 2.3

Using $\alpha = 1/4$, $\delta = 1/2$ and equations 2.3.1, 2.3.2, 3.3.7.2, the three equations obtained are in generalized coordinate for mode 'j'.

$$y_e = y_o\left(\frac{b}{a}\right) + \dot{y}_o\left(\frac{c}{a}\right) + (\ddot{y}_o - \Gamma_j \ddot{U}_g)\frac{1}{a} \qquad 3.3.7.1.1$$

$$\dot{y}_e = \left(\frac{2}{h}\right)(y_e - y_o) - \dot{y}_o \qquad 3.3.7.1.2$$

$$\ddot{y}_e = \frac{4}{h^2} y_e - \frac{4}{h^2} y_o - \frac{4}{h}\dot{y}_o - \ddot{y}_o \qquad 3.3.7.1.3$$

where,

$$a = \omega_j^2 + \frac{4}{h^2} + \frac{4\omega_j \lambda_j}{h} \qquad 3.3.7.1.4$$

$$b = \frac{4}{h^2} + \frac{4\omega_j \lambda_j}{h} \qquad 3.3.7.1.5$$

$$c = \frac{4}{h} + 2\omega_j \lambda_j \qquad 3.3.7.1.6$$

and h = time step = 0.005 second

Γ_j, ω_j, λ_j has been defined before

$\ddot{U}_g$ = average acceleration in each time step

subscript 'O' indicates value at beginning and 'e' indicates at the end of time step.

Y, $\dot{Y}$, $\ddot{Y}$ are displacement, velocity, acceleration respectively for generalized co-ordinate

3.3.7.1.1 Calculation of Response

At end of each time step 'h' value of ye is obtained for all the modes to be considered. The final response at end of each time step is calculated as follows :

(a) Deformation at time 't'

$$\{X\}_{nx1} = [\phi]_{nxp}\{Y\}_{px1}\{\alpha\}_{nx1}$$

where $\{X\}_{nx1}$ is deformation in global coordinate

$\{\alpha\}_{nx1}$ is a vector having value of 1 in direction in which earthquake is acting and '0' in which no earthquake is acting e.g.

$$\{\alpha\} = \begin{Bmatrix} 1 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ \cdots\cdots \\ 1 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \end{Bmatrix}$$

if earthquake is acting in direction 'x'
p = No. of modes considered

(b) Forces in members at time 't'

$$\{F\}_{12x1} = [K]_{12x12} \{X\}_{12x1}$$

(c) The deformation and forces are calculated at end of each time step 'h' and maximum value of displacement and forces irrespective of sign are found out.

(d) Calculation from 'a' to 'c' is done for earthquake's acting in 'x', 'y', 'z' direction one by one and final response R is calculated by SRSS rule mentioned in 2.5.1

$$R_j = \sqrt{\sum_{j=1}^{3} (R_{ij})^2}$$

R_i = response in ith degree of freedom

R_{ij} = response in ith degree of freedom due to earthquake in jth direction

3.3.7.2 COMPUTER PROGRAM

A computer program SPTH.F in language Fortran-77 compatible to HICIX system has been developed by candidate to calculate the response by mode superposition time-history method for any given ground acceleration time-history. The listing is in appendix B.

3.3.8 Response Spectrum Method :

In the response spectrum method the uncoupled equation of motion for 'j'th mode in generalized coordinate is

$$Y_j + 2\ \lambda_j\ \omega_j\ \dot{Y}_J + \omega_j^2\ Y_j = -\ \Gamma_j\ \ddot{U}_g \qquad 3.3.3.1$$

This equation is same as mentioned in 3.3.7 and meaning of terms are also same as mentioned in article 3.3.7.

The calculation of response is done in following way for earthquake acting in each direction i.e. X, Y, Z.

(a) Generalized response of each mode 'j' is determined as

$$y_j\ (\max) = \Gamma_j\ \left(\frac{Saj}{\omega_j^2}\right) \qquad 3.3.8.2$$

where, S_{aj} = spectral acceleration corresponding to frequency w_j

(b) The maximum displacement of ith degree of freedom relative to base in mode 'j' is

$$X_{ij}(\max) = \phi_{ij}\ \ Y_j(\max)\ \alpha \qquad 3.3.8.3$$

where $\alpha = 1$, if direction of ith degree of freedom and direction of earthquake is some.

$\alpha = 0$ if both directions mentioned above are not same

(c) The forces in each element in each mode is calculated as

$$\{F\}_{12x1} = [K]_{12x12} \{X\}_{12x1}$$

(d) Modal combination - The results calculated in b, and c above in each mode for earthquake in one direction say 'x' are combined by following modal combination rules as discussed in 2.5.1 in detail.

(i) SRSS (Square root of sum of the squares)

$$R_i = [\sum_{j=1}^{b} R_{ij}^2]^{1/2}$$

R_i = ith response

R_{ij} = ith response in jth mode

p = total number of modes considered as per 3.3.6

(ii) CQC (Complete quadratic combination)

$$R_i = \left[\sum_{j=1}^{p} \sum_{k=1}^{p} \rho_{jk} R_{ik} R_{ij} \right]^{\frac{1}{2}}$$

where,

$$\rho_{ik} = \frac{8 \sqrt{\eta_j \eta_k} (\eta_j + \frac{\omega_k}{\omega_j} \eta_j) (\frac{\omega_k}{\omega_j})^{3/2}}{[(1-(\frac{\omega_k}{\omega_j})^2)^2 + 4 \eta_j \eta_k \frac{\omega_k}{\omega_j} (1+(\frac{\omega_k}{\omega_j})^2) + 4 (\eta_j^2 + \eta_k^2) (\frac{\omega_k}{\omega_j})^2]}$$

η_j, η_k are damping ratios in modes j & k ; if $\frac{\omega_j}{\omega_k} < \frac{0.2}{\eta_j+\eta_k} \Rightarrow$

$\rho_{jk} =$ 0.1 and it is neglected.

(ii) if $\frac{\omega_k - \omega_j}{\omega_j} \le 0.1$ $\qquad 1 \le j \le k$

groups are formed as discussed in 2.5.1.

Grouping method :

$$R_j = \left[\sum_{j=1}^{N} R_{ij}^{2} + \sum_{k=}^{n_c} \sum_{l=p}^{q} \sum_{m=p}^{q} |R_{ilk}, R_{imk}| \right]^{1/2}_{l \neq m}$$

where,

n_c = no of closely spaced group

p = number of nodes where grouping starts

q = number of nodes where grouping ends

R_{ilk} , R_{imk} - modal response within 'k' group for j th component in mode l & m respectively.

(iv) 10% method.

$$R_j = \left[\sum_{j=1}^{N} R_{ij}^{2} + 2 \sum |R_{ik} R_{il}| \right]^{1/2}_{k \neq l}$$

Second summation to be done if

$\omega_k < \omega_l \le 0.1\ \omega_k$

$1 < k < l \le n$

(v) Double sum method

$$R_i = \left[\sum_{j=1}^{N} \sum_{k=1}^{N} \epsilon_{jk} |R_{ij} R_{ik}| \right]^{1/2}$$

$$\epsilon_{jk} = \left[1 + \left\{\frac{w_j' - w_k'}{\beta_j' \; w_j' + \beta_k' \; w_k)}\right\}^2\right]^{-1}$$

$$w_k' = w_k \; [1-\beta_k^2 \;]^{1/2}$$

where β_k = modal damping of k th mode

ω_k = frequency of K^{th} mode

$$\beta'_k = \beta_k + \frac{2}{t \quad \omega_k}$$

td = duration of earthquake

(e) After carrying out above modal combination for earthquake in each direction x,y,z, the final response is calculated by spatial combination rule mentioned in article 2.5.2. i.e.

(i) SRSS

$$R_i \sqrt{\sum_{j=1}^{3} \quad R_{ij}^2}$$

(ii) Spatial combination B

$$R_i \pm \; [R_{ij} + 0.4 \; R_{i2} + 0.4 \; R_{13}]$$

(iii) Spatial combination C

$$R_i \; = \pm[0.4 \; R_{i1} + R_{i2} + 0.4 R_{i3}]$$

(iv) Spatial combination D

$$R_i \; = + \; [0.4 \; R_{i1} \; + \; 0.4 \; R_i 2 \; + \; 1.0 R_i 3]$$

where,

1,2,3 indicates responses due to earthquake in x,y,z directions respectively.

- Response spectra used is shown in figure - 1

3.8.1 Computer program :

The program DA25.F has been developed by the candidate in Fortran - 77 language compatible to HICIX system,for this purpose. The listing is in appendix C.

3.4 Study of modal combination rules

The results obtained by methods discussed in 3.3.8 i.e. by different modal combination rules in response spectra method has been compared with results obtained by time history method discussed in article 3.3.7 considering the later as standard and suitability of modal combination rule is discussed in chapter 4 and 5.

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CHAPTER - 4

DISCUSSION OF RESULTS

4.1 STRUCTURES CHOSEN FOR STUDY :

Three types of structures i.e. building frames have been chosen as follows :

(i) Building I - It is unsymmetrical in all X ,Y,Z directions. Base is fixed. Material used is R.C.C. The isometric view giving details of node numbering, element numbering and other dimensions have been shown in figure 5.

(ii) Building II - Building II is stepped at second floor. Total number of story is 4. The isometric view giving node, member numbering and other details is shown in figure 6.

(iii) Building III - Building III chosen is symmetric. The isometric view giving all details as in previous cases is shown in figure 7.

4.2 Properties of material

(i) Modulus of Elasticity

For uncracked section of R.C.C. the value of E as suggested in IS:456-1978 is

$$E = 5700 \sqrt{fck} \qquad N/mm^2$$

fck = characteristic strength of conc.

In the present thesis M20- concrete has been chosen and corresponding value of $E \approx 2.5 \times 10^{10}$ has been adopted.

(ii) Damping

Damping for R.C.C. should be taken as 4% - 8% as per ASCE-4-86. In this thesis the value of damping adopted is 5%.

4.3 SPECTRA USED

The Blume spectra shown in figure 1, has been adopted for response spectrum analysis. The same spectra is used for all three directions with a multiplication of 0.5 in vertical direction only, shown in figure 2.

4.4 Time History

The time history of acceleration corresponding to response spectra mentioned above has been used in the present thesis for time history analysis.

The initial values for time history analysis are :

(i) ZPA = 0.25 g

(ii) Initial displacement = 0.0

" velocity = 0.0

" Acceleration = 0.0

(iii) Time step 'h' = 0.005 second

The same time-history has been used in three directions with value of acceleration half in vertical direction as compared to that in horizontal directions.

4.5 Results

4.5.1 Building I

4.5.1.1 EIGEN VALUES AND EIGEN VECTORS

The modal frequency, mode participation factor, cumulative modal mass of all modes are shown in table 5 in which the symbolic representations are as follows :

'n' frr = AXX

(i) n = No. of mode under consideration

(ii) frr = frequency (in cps)

(iii) dp = modal damping

(iv) px = mode participation factor in x direction

py = mode participation factor in y direction

pz = mode participation factor in z direction(vertical)

(v) mx = modal mass in x direction

my = modal mass in y direction

mz = modal mass in z direction

(vi) Cmx = cumulative modal mass in x direction

Cmy = cumulative modal mass in y direction

Cmz = cumulative modal mass in z direction

4.5.1.2 The results obtained by response spectrum method by different modal combination rules combined with three spatial combination rules have been shown in table 6. (Results of only typical nodes and members have been chosen).

4.5.1.3 The corresponding results obtained by time-history analysis is shown in table 7.

(Above results are in Global coordinate system)

4.5.1.4 The errors in results of response spectrum method with respect to time history method is shown in table 8.

4.5.2 Building II - The results in same sequence as mentioned from 4.5.1.1 to 4.5.1.4 have been given in tables 9, 10, 11, 12 respectively for this building.

4.5.3 Building III - The results of this building in same sequence are given in tables 13, 14, 15, 16 respectively.

4.6 Discussion

The average errors and maximum errors for different modal combination rules for building I, II, III are given in table 17, 18, 19 respectively.

The following observations can be drawn from tables 5 to 19

(i)The spatial combination rule 2 i.e (B , $1.0R_1+0.4R_2+0.4R_3$), 3(C, $0.4R_1+1.0R_2+0.4R_3$), 4 (D; $0.4R_1+0.4R_2+1.0R_3$) gives very large error of the order of 0.70 as compared to T.H.A. results.So in further discussions these spatial combinations shall not be considered

(ii)The results from Grouping and 10% methods are comparable

(iii)In the unsymmetrical buildings i.e 1,& 2 most of the results by all modal combination rules are lesser than that obtained by time history analysis but in symmetrical case these are larger than that obtained by T.H.A.

(iv)On the basis of Average Error calculated in Table 17,18,19(Av. error has been calculated for all displacement $>10^{-10}$ m. and force $>10^{-2}$) the different modal combination rules in increasing average error are Double Sum,CQC,Grouping & 10%, SRSS for both displacement and forces.

(v)The standard deviation of error the results are least for Double Sum, followed by CQC, Grouping & 10%, and max for SRSS.

(vi) Following recommendations can be made to get the results equal to or greater than that by T.H.A.

If $R_{THA} < R_{RST} * F$

where F is multiplying factor

Factor F for displacements

method	F
Double Sum	1.156
CQC	1.178
Grouping & 10 %	1.256
SRSS	1.26

Factors for forces

method	F
Double Sum	1.153
CQC	1.203
Grouping & 10%	1.273
SRSS	1.31

CHAPTER - 5

CONCLUSION

5.1 CONCLUSION - The final conclusion can be made like this

(i) Spatial combination A (SRSS) should be used for combining the responses due to earthquake in three directions

(ii) The results obtained by Double Sum method gives least error followed by CQC ,Grouping & 10% and SRSS which gives maximum error

(iii) For design purposes the forces obtained by Double Sum,CQC ,Grouping ,10 %,and SRSS should be multiplied by a factor 1.153,1.203,1.273,1.273 ,1.31 respectively for forces and 1.156, 1.178,1.256,1.256 , 1.26 respectively for displacements.

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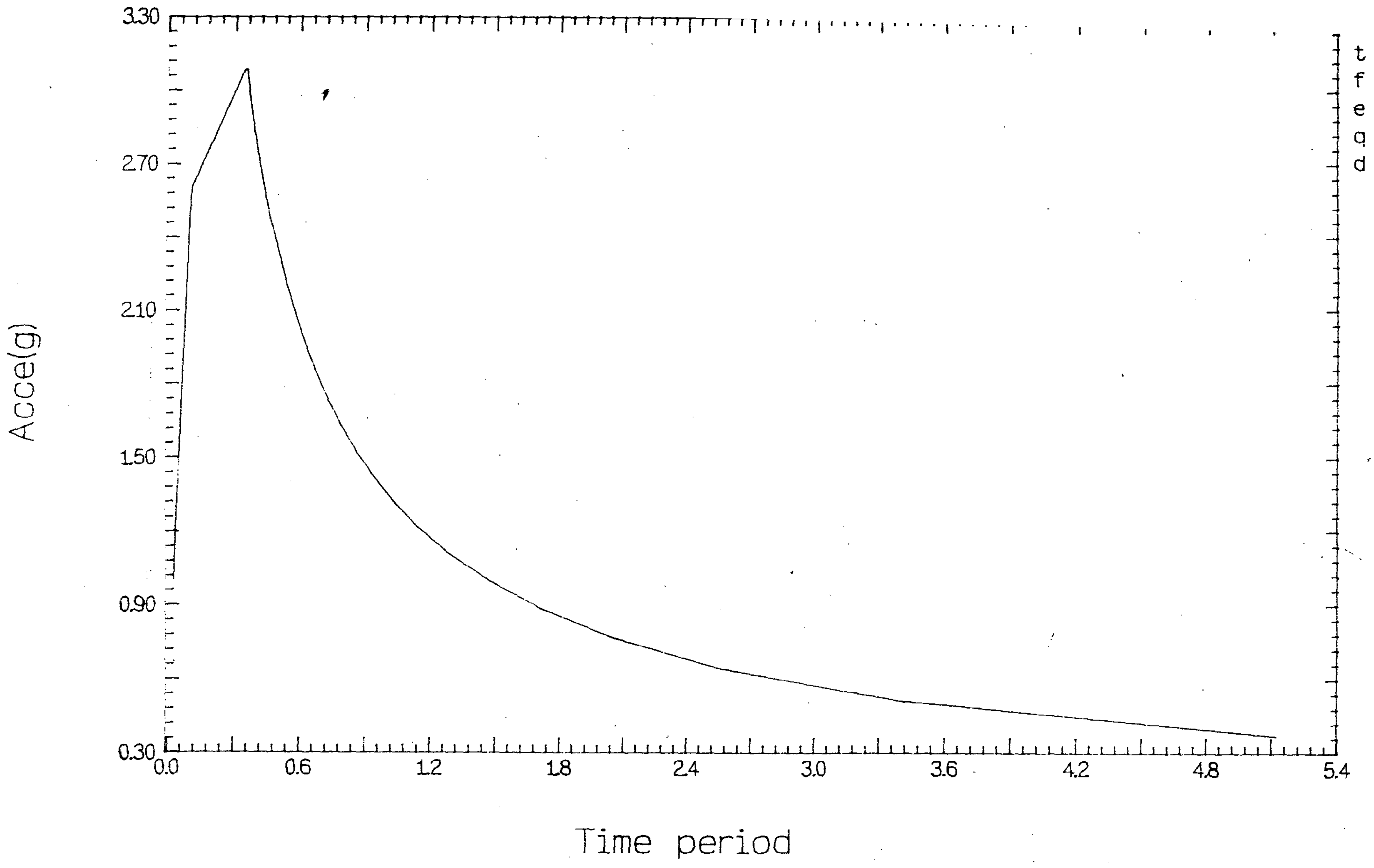
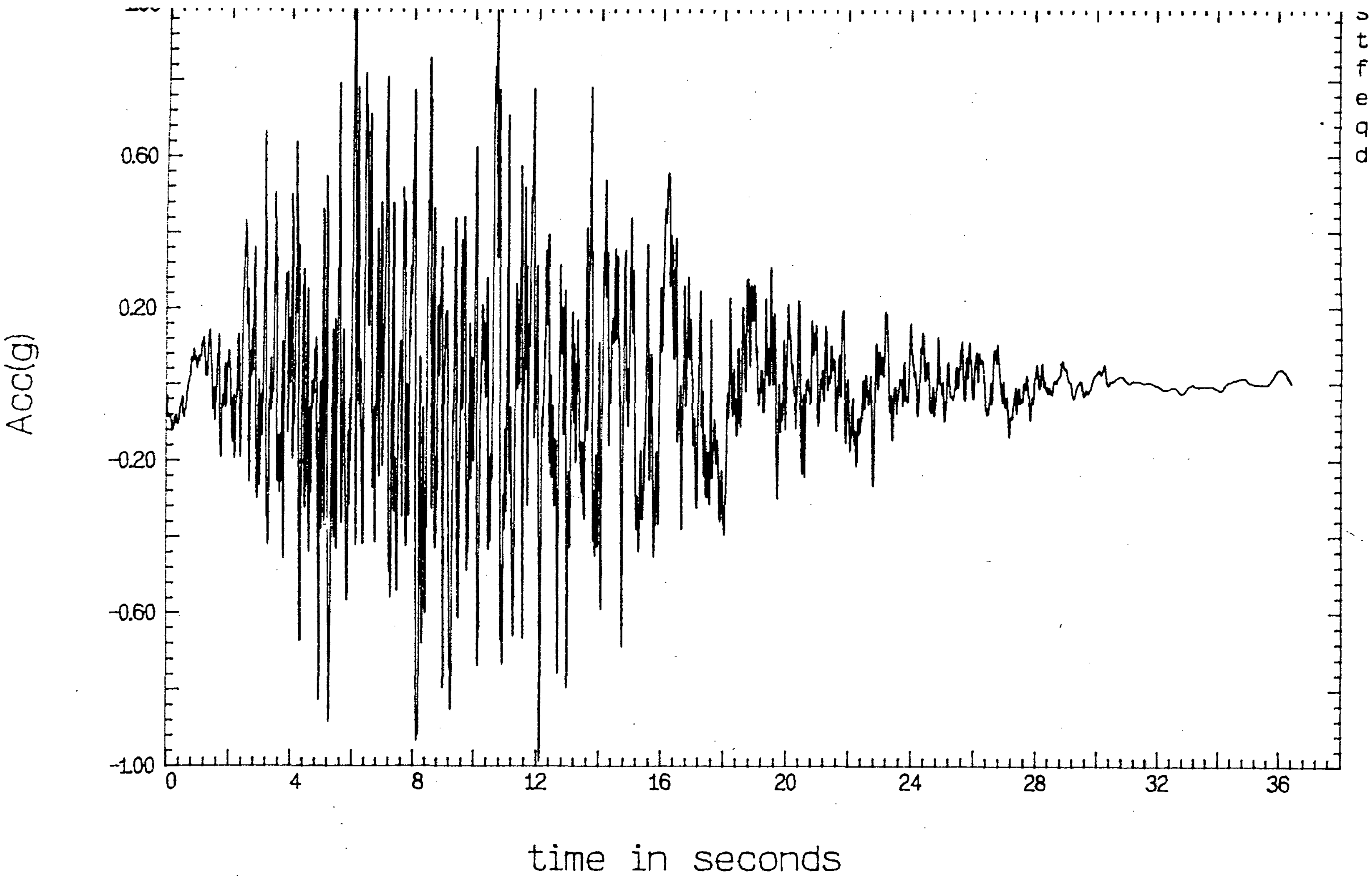


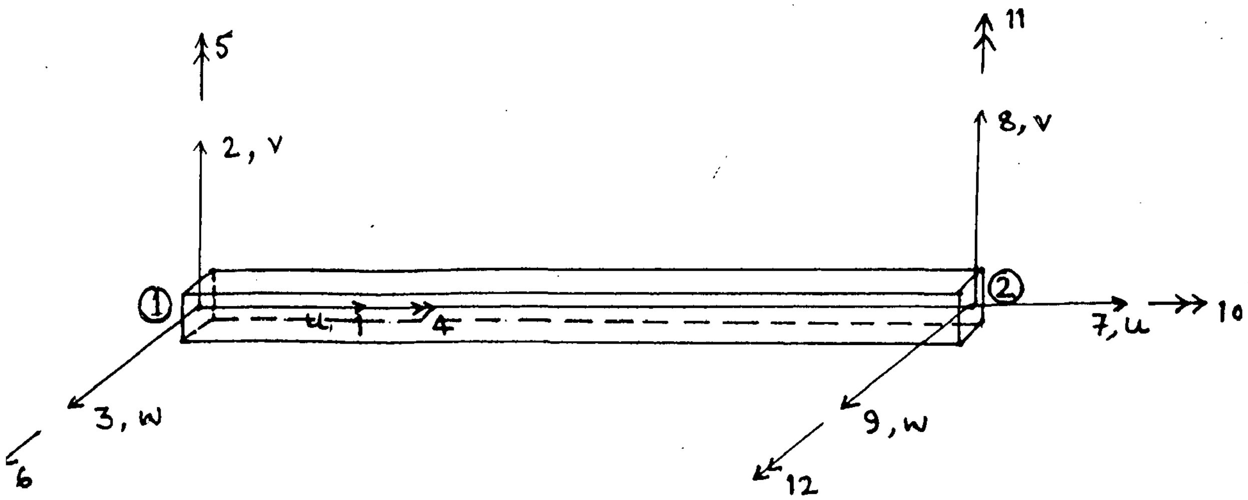
RESPONSE SPECTRA

FIG - 1

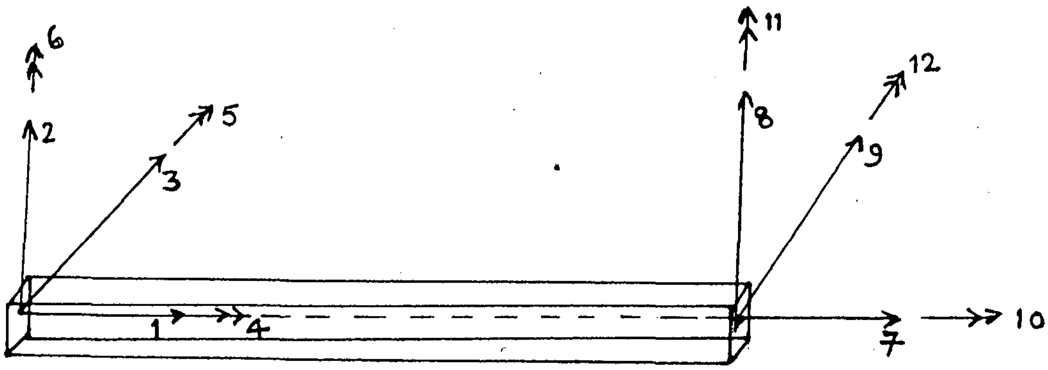


TIME HISTORY ACCELERATION

FIG-2

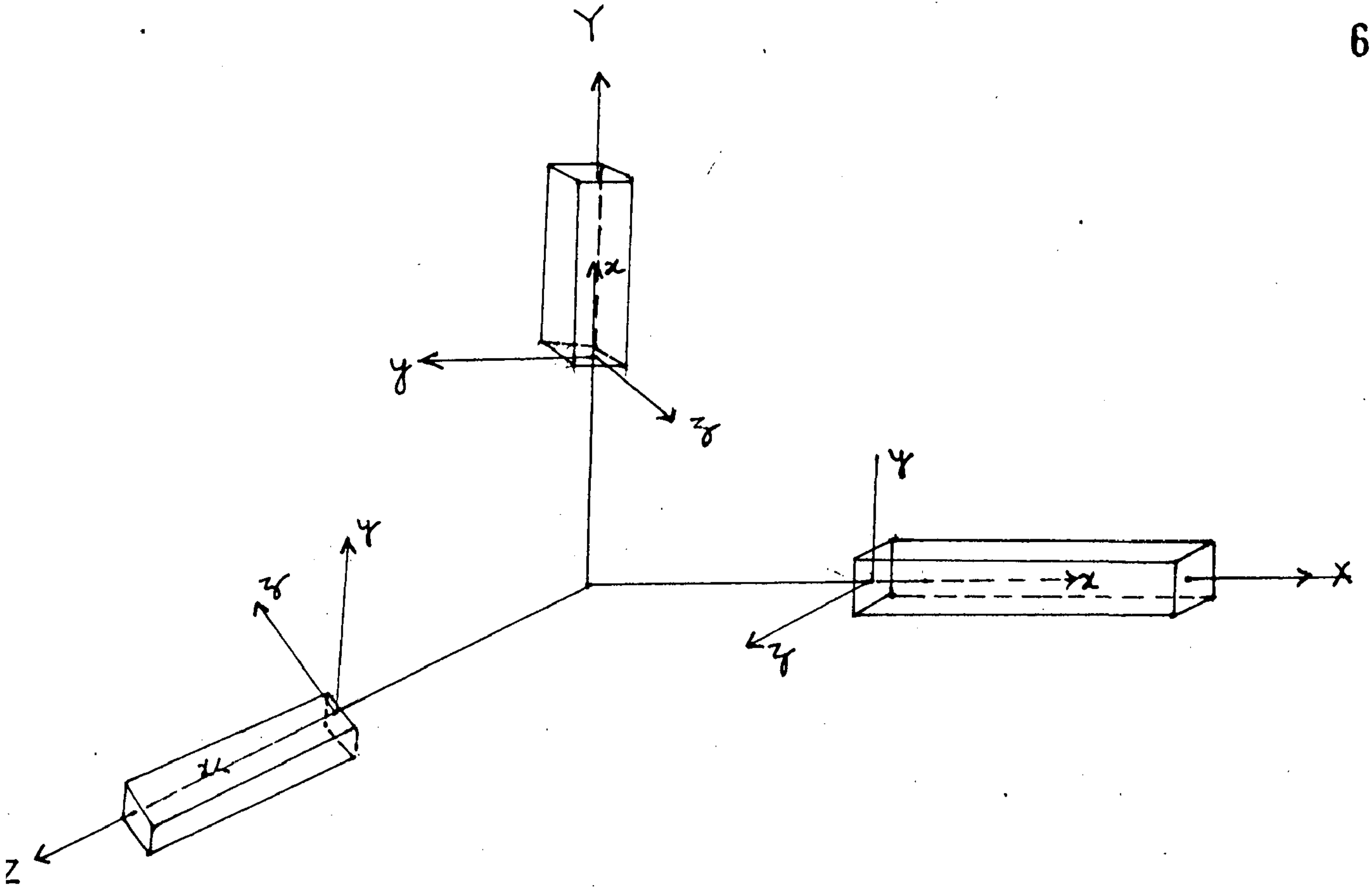


1. BEAM ELEMENT WITH 12 DEGREES OF FREEDOM
(AS USED IN PROG. SPACE·F)

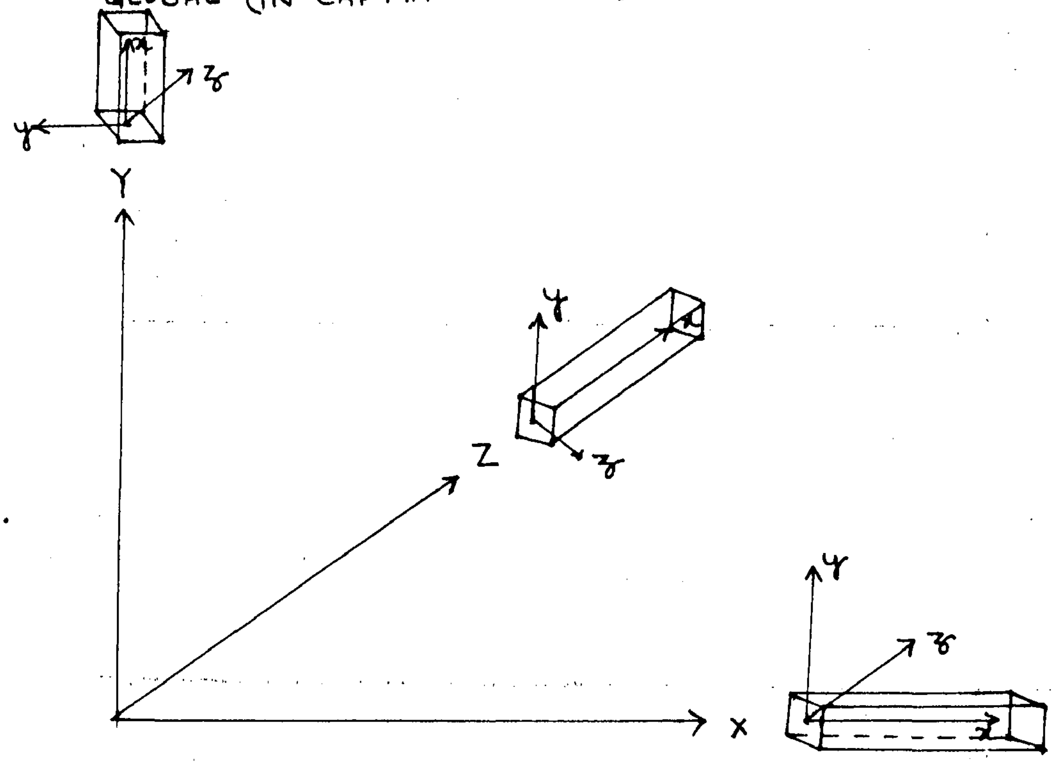


2. BEAM WITH 12 DEGREES OF FREEDOM
(AS USED IN REST OTHER PROGRAMS)

FIG-3

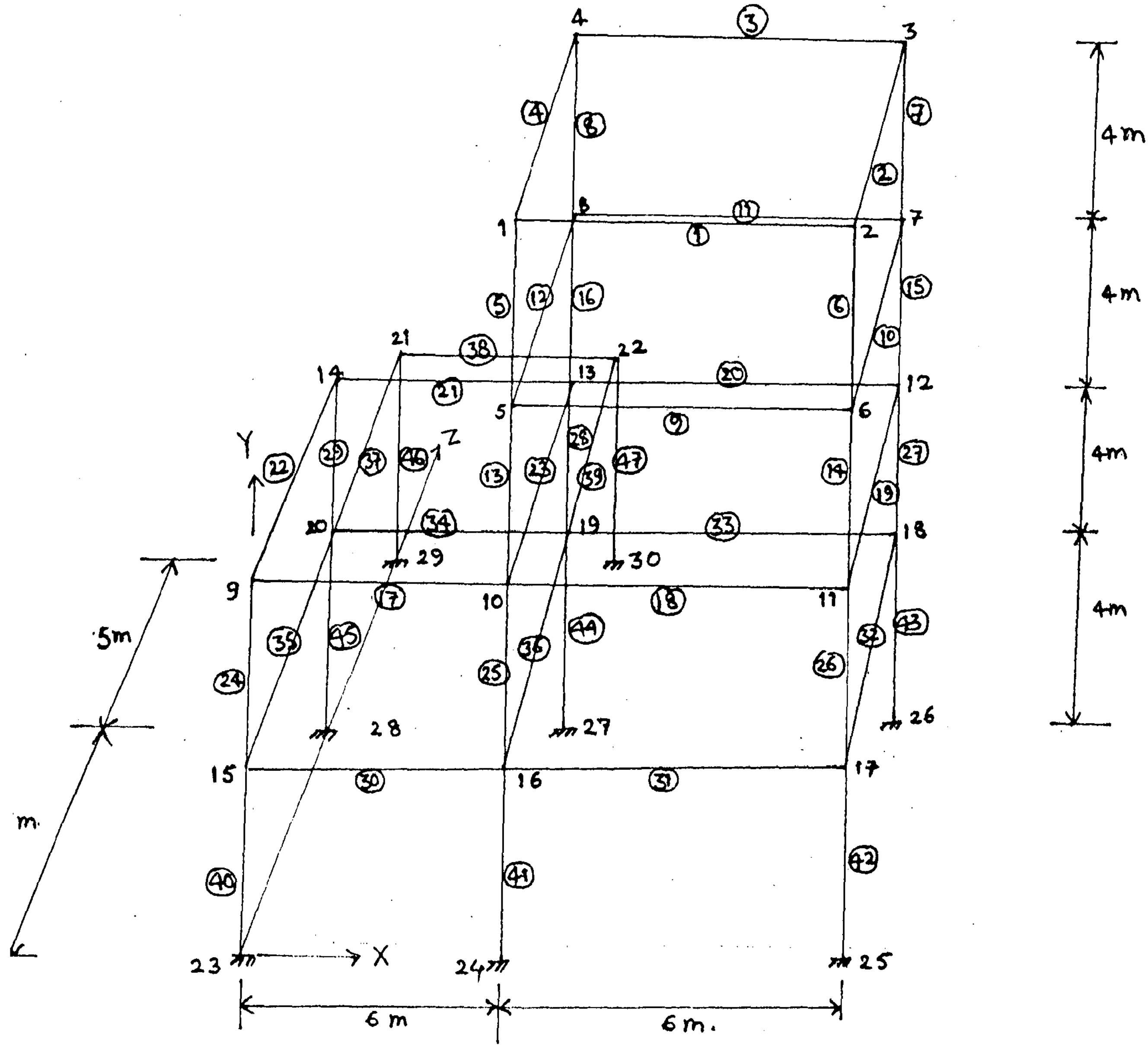


1. COORDINATE SYSTEMS LOCAL (IN SMALL LETTERS) & GLOBAL (IN CAPITAL LETTERS) AS USED IN SPACE.F



2. COORDINATES LOCAL (IN SMALL LETTERS)AND GLOBAL IN (CAPTAL LETTERS) AS USED IN REST OTHER PROGRAMMS

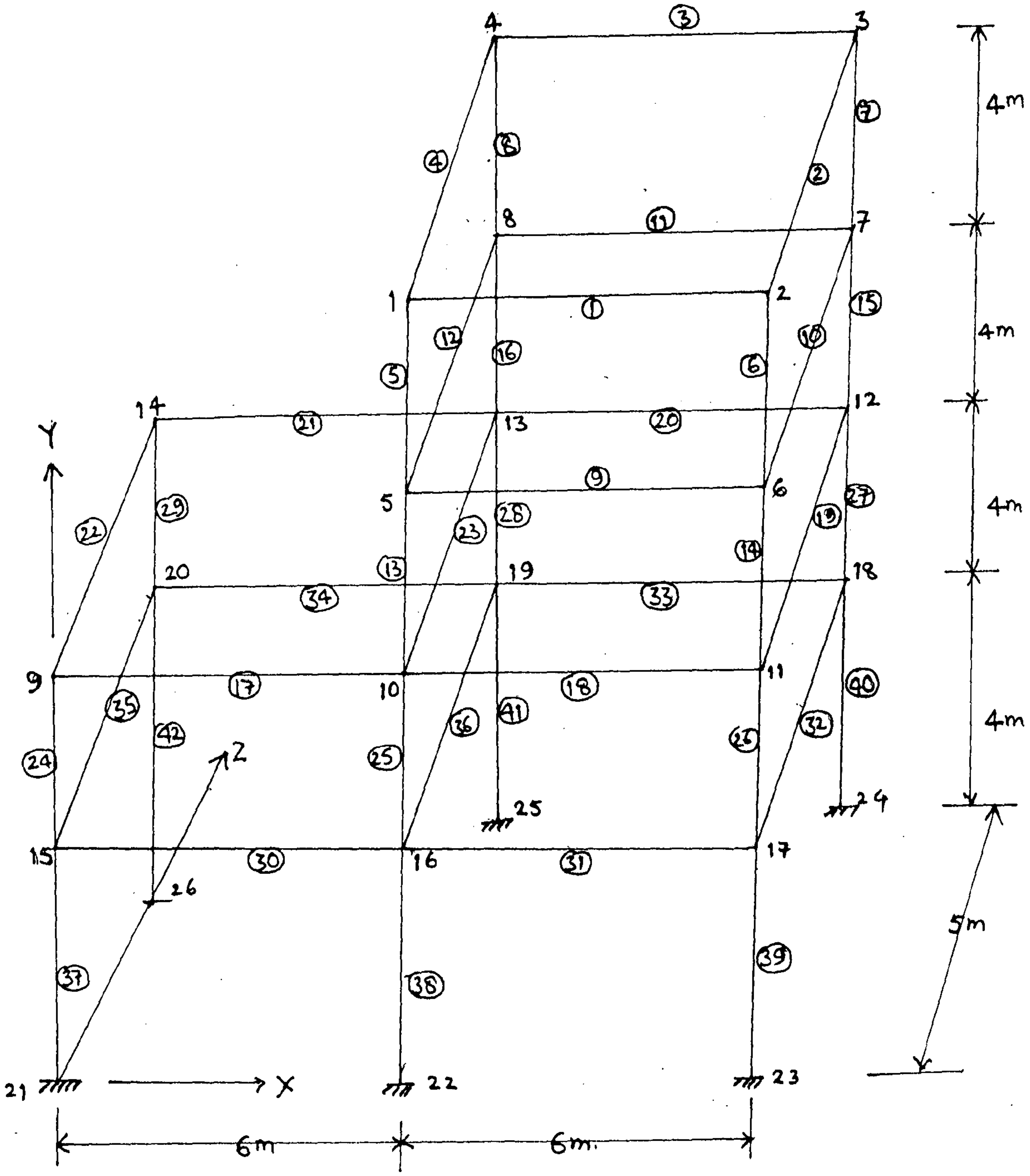
FIG.-4



BUILDING-1

DIMENSIONS IN METRES

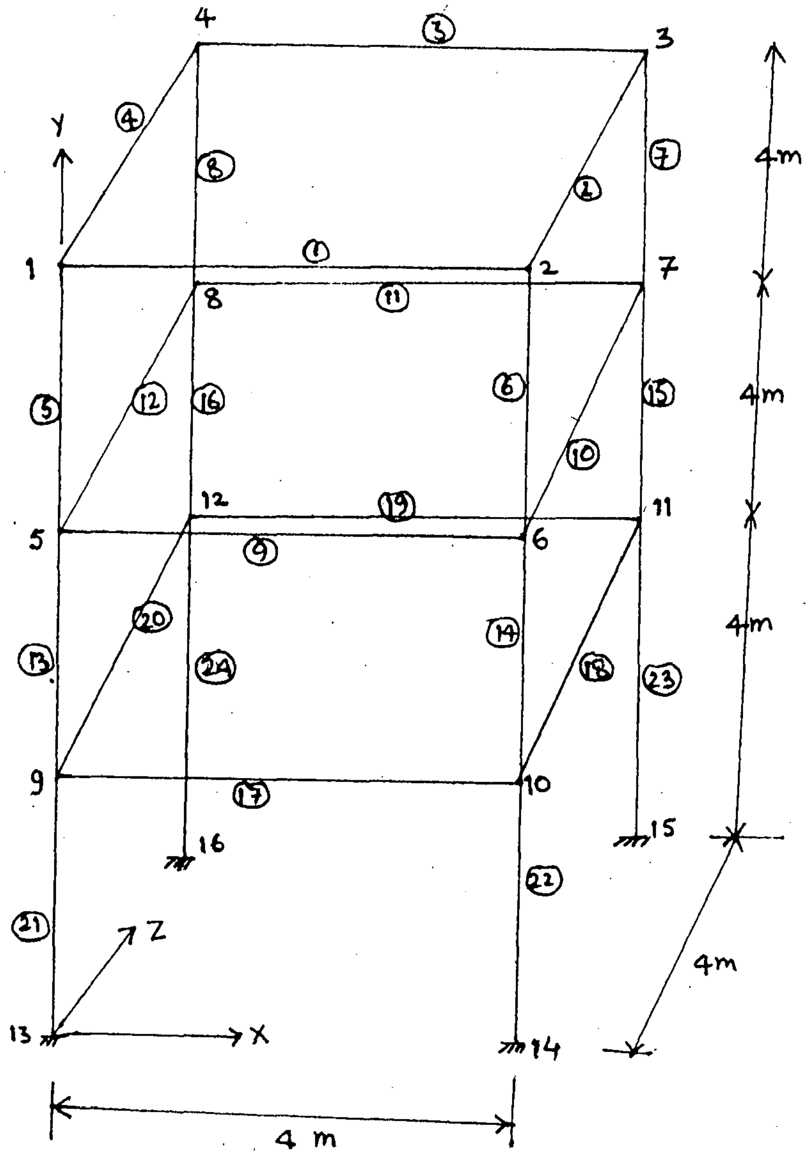
FIG. -5



BUILDING-2

[DIMENSIONS IN M.]

FIG-6.



(BUILDING - 3, ALL DIMENSIONS IN METRE)

FIG.- 7

TABLE 1

	1	2	3	4	5	6	7	8	9	10	11	12
1	C1	0	0	0	0	0	-C1	0	0	0	0	0
2		C2	0	0	0	C'2	0	-C2	0	0	0	0
3			C3	0	C'3	0	0	0	-C3	0	-C'3	0
4				C4	0	0	0	0	0	-C4	0	0
5					C5	0	0	0	-C'3	0	C'5	0
6						C6	0	-C'2	0	0	0	C'6
[K]= 7							C1	0	0	0	0	0
8								C2	0	0	0	-C'2
9		SYMMETRIC							C3	0	-C'3	0
10										C4	0	0
11											C5	0
12												C6

ELEMENT STIFFNES MATRIX IN

LOCAL CO-ORDINATE SYSTEM, MEANINGS OF CONSTANTS ARE GIVEN IN TABLE 2

TABLE 2

CONSTANTS

C1	$= \frac{EA}{L}$	E	= Modulus of Elasticity
C2	$= \frac{12EI_{zz}}{L^3 (1+\phi y)}$	A	= Are of cross section
C3	$= \frac{12EI_{yy}}{L^3(1+\phi_z)}$	I_{zz}	= Moment of inertia about zz
C4	$= \frac{GJ}{L}$	I_{yy}	= Moment of inertia about yy
C5	$= \frac{(4+\phi_z)EI_{yy}}{L(1+\phi_z)}$	G	= Modulus of rigidity
C6	$= \frac{(4+\phi_y)\ EI_{zz}}{L(1+\phi_y)}$	A_{sy}	= Shear area along y direction
C'2	$= \frac{6EI_{zz}}{L^2(1+\phi_y)}$	ϕ_y	$= \frac{12EI_z}{GA_{sy}L^2}$
C'3	$= \frac{-6FI_{zz}}{L^2(1+\phi_z)}$	ϕ_z	$= \frac{12EI_y}{GA_{sz}\ L^2}$
C'5	$= \frac{(2-\phi_z)\ EI_{yy}}{L(1+\phi_z)}$		
C'6	$= \frac{(2-\phi_y)\ EI_{zz}}{L(1+\phi_y)}$		

TABLE 3

TRANSFORMATION MATRIX [T]

$$[T] = \begin{bmatrix} [T1] & 0 & 0 & 0 \\ 0 & [T1] & 0 & 0 \\ 0 & 0 & [T1] & 0 \\ 0 & 0 & 0 & [T1] \end{bmatrix}$$

where

$$[T1] = \begin{bmatrix} lox & mox & nox \\ loy & moy & noy \\ loz & moz & noz \end{bmatrix}$$

where lox = cosine of angle between local x axis and global X axis

mox = cosine of angle between local x axis and global Y axis

nox = cosine of angle between local x axis and global Z axis

similarly for other local axis oy, and oz.

TABLE 4

MASS MATRIX (LUMPED MASS MATRIX) FOR ELEMENT IN LOCAL CO-ORDINATE SYSTEM

1	m1	0	0	0	0	0	0	0	0	0	0	0
2		m1	0	0	0	0	0	0	0	0	0	0
3			m1	0	0	0	0	0	0	0	0	0
4				0	0	0	0	0	0	0	0	0
5					0	0	0	0	0	0	0	0
6						0	0	0	0	0	0	0
$[M]_{12X12}$ = 7							m1	0	0	0	0	0
8								m1	0	0	0	0
9		SYMMETRIC							m1	0	0	0
10										0	0	0
11											0	0
12												0
	1	2	3	4	5	6	7	8	9	10	11	12

m_1 = (total mass of uniform beam)/2

Rotational inertia has been neglected

TABLE - 5

```
------------------------------------------------------------------------------------------
              Properties of modes of Building 1
------------------------------------------------------------------------------------------

mode   1   1 fr=  0.25531E+01 dp=  0.0500 px=  0.13533E+01  py=  0.40320E-02  pz=  0.18174E+00
mx=  0.82590E+00  my=  0.73316E-05  mz=  0.14895E-01 cmx=  0.82590E+00 cmy=  0.73316E-05 cmz=  0.14895E-01
mode   2   2 fr=  0.29813E+01 dp=  0.0500 px= -0.29457E+00  py=  0.39984E-02  pz=  0.15145E+01
mx=  0.28031E-01  my=  0.51645E-05  mz=  0.74095E+00 cmx=  0.85393E+00 cmy=  0.12496E-04 cmz=  0.75585E+00
mode   3   3 fr=  0.41739E+01 dp=  0.0500 px=  0.29463E+00  py=  0.23872E-02  pz=  0.79244E+00
mx=  0.19186E-01  my=  0.12595E-05  mz=  0.13880E+00 cmx=  0.87311E+00 cmy=  0.13756E-04 cmz=  0.89464E+00
mode   4   4 fr=  0.52241E+01 dp=  0.0500 px=  0.95295E-01  py=  0.19839E-02  pz= -0.13916E+00
mx=  0.34245E-02  my=  0.14842E-05  mz=  0.73027E-02 cmx=  0.87654E+00 cmy=  0.15240E-04 cmz=  0.90194E+00
mode   5   5 fr=  0.92811E+01 dp=  0.0500 px= -0.10238E+00  py=  0.91439E-02  pz= -0.19267E+00
mx=  0.72814E-02  my=  0.58084E-04  mz=  0.25787E-01 cmx=  0.88382E+00 cmy=  0.73323E-04 cmz=  0.92773E+00
mode   6   6 fr=  0.95002E+01 dp=  0.0500 px=  0.76282E-01  py= -0.32246E-04  pz= -0.20106E+00
mx=  0.11684E-02  my=  0.20878E-09  mz=  0.81167E-02 cmx=  0.88499E+00 cmy=  0.73324E-04 cmz=  0.93585E+00
mode   8   7 fr=  0.10613E+02 dp=  0.0500 px=  0.27500E+00  py= -0.21297E-01  pz=  0.24209E+00
mx=  0.27620E-01  my=  0.16564E-03  mz=  0.21405E-01 cmx=  0.91261E+00 cmy=  0.23897E-03 cmz=  0.95725E+00
mode   7   8 fr=  0.10139E+02 dp=  0.0500 px= -0.26755E+00  py=  0.33135E-02  pz=  0.28099E+00
mx=  0.32694E-01  my=  0.50147E-05  mz=  0.36061E-01 cmx=  0.94530E+00 cmy=  0.24398E-03 cmz=  0.99331E+00
mode   9   9 fr=  0.13638E+02 dp=  0.0500 px= -0.67726E-01  py= -0.33245E-02  pz=  0.88065E-01
mx=  0.18568E-02  my=  0.44741E-05  mz=  0.31396E-02 cmx=  0.94716E+00 cmy=  0.24845E-03 cmz=  0.99645E+00
mode  10  10 fr=  0.14496E+02 dp=  0.0500 px= -0.23954E-01  py= -0.86715E-02  pz= -0.55272E-01
mx=  0.24898E-03  my=  0.32629E-04  mz=  0.13256E-02 cmx=  0.94741E+00 cmy=  0.28108E-03 cmz=  0.99778E+00
mode  11  11 fr=  0.16646E+02 dp=  0.0500 px=  0.69611E+00  py=  0.13489E-01  pz=  0.51381E-02
mx=  0.42682E-01  my=  0.16027E-04  mz=  0.23254E-05 cmx=  0.99009E+00 cmy=  0.29711E-03 cmz=  0.99778E+00
mode  12  12 fr=  0.27426E+02 dp=  0.0500 px=  0.23808E-02  py=  0.17329E-01  pz=  0.89515E-01
mx=  0.22468E-05  my=  0.11904E-03  mz=  0.31763E-02 cmx=  0.99009E+00 cmy=  0.41615E-03 cmz=  0.10010E+01
mode  12  13 fr=  0.28900E+02 dp=  0.0500 px= -0.38286E-01  py= -0.30303E-01  pz=  0.16113E-02
mx=  0.46217E-03  my=  0.28952E-03  mz=  0.81856E-06 cmx=  0.99055E+00 cmy=  0.70567E-03 cmz=  0.10010E+01
mode  12  14 fr=  0.31184E+02 dp=  0.0500 px=  0.12834E+00  py= -0.25450E-01  pz= -0.38695E-02
mx=  0.39819E-02  my=  0.15658E-03  mz=  0.36195E-05 cmx=  0.99453E+00 cmy=  0.86225E-03 cmz=  0.10010E+01
mode  12  15 fr=  0.34303E+02 dp=  0.0500 px=  0.98904E-03  py=  0.11928E+01  pz= -0.88346E-02
mx=  0.20020E-06  my=  0.29117E+00  mz=  0.15974E-04 cmx=  0.99453E+00 cmy=  0.29203E+00 cmz=  0.10010E+01

no. of considered =  14
```

****

NODAL DISP. IN GLOBAL OF BUILD. 1 (R.S.T)

****

NODE = 1

spatial combination A (srss)

method	node	Ux	Uy	Uz	Rxx	Ryy	Rzz
SRSS	1	0.365103E-01	0.101285E-05	0.272395E-01	0.000000E+00	0.000000E+00	0.000000E+00
CQC	1	0.366611E-01	0.117050E-05	0.275187E-01	0.000000E+00	0.000000E+00	0.000000E+00
GROUPING	1	0.365138E-01	0.102723E-05	0.272416E-01	0.000000E+00	0.000000E+00	0.000000E+00
10 %	1	0.365138E-01	0.102951E-05	0.272416E-01	0.000000E+00	0.000000E+00	0.000000E+00
DOUBLE SUM	1	0.367383E-01	0.118793E-05	0.276510E-01	0.000000E+00	0.000000E+00	0.000000E+00

spatial combination B (R=R1+0.4R2+0.4R3)

SRSS	1	0.365103E-01	0.405141E-06	0.108958E-01	0.000000E+00	0.000000E+00	0.000000E+00
CQC	1	0.366611E-01	0.468202E-06	0.110075E-01	0.000000E+00	0.000000E+00	0.000000E+00
GROUPING	1	0.365138E-01	0.410894E-06	0.108966E-01	0.000000E+00	0.000000E+00	0.000000E+00
10 %	1	0.365138E-01	0.411805E-06	0.108966E-01	0.000000E+00	0.000000E+00	0.000000E+00
DOUBLE SUM	1	0.367383E-01	0.475173E-06	0.110604E-01	0.000000E+00	0.000000E+00	0.000000E+00

spatial combination C (R=0.4R1+R2+0.4R3)

SRSS	1	0.146041E-01	0.101285E-05	0.108958E-01	0.000000E+00	0.000000E+00	0.000000E+00
CQC	1	0.146644E-01	0.117050E-05	0.110075E-01	0.000000E+00	0.000000E+00	0.000000E+00
GROUPING	1	0.146055E-01	0.102723E-05	0.108966E-01	0.000000E+00	0.000000E+00	0.000000E+00
10 %	1	0.146055E-01	0.102951E-05	0.108966E-01	0.000000E+00	0.000000E+00	0.000000E+00
DOUBLE SUM	1	0.146953E-01	0.118793E-05	0.110604E-01	0.000000E+00	0.000000E+00	0.000000E+00

spatial combination D (R=0.4R1+0.4R2+R3)

SRSS	1	0.146041E-01	0.405141E-06	0.272395E-01	0.000000E+00	0.000000E+00	0.000000E+00
CQC	1	0.146644E-01	0.468202E-06	0.275187E-01	0.000000E+00	0.000000E+00	0.000000E+00

ROUPING	1	0.146055E-01	0.410894E-06	0.272416E-01	0.000000E+00	0.000000E+00	0.000000E+00
10 %	1	0.146055E-01	0.411805E-06	0.272416E-01	0.000000E+00	0.000000E+00	0.000000E+00
OUBLE SUM	1	0.146953E-01	0.475173E-06	0.276510E-01	0.000000E+00	0.000000E+00	0.000000E+00

NODE = 5

spatial combination A (srss)

ethod	node	Ux	Uy	Uz	Rxx	Ryy	Rzz
RSS	5	0.324453E-01	0.974944E-06	0.213826E-01	0.000000E+00	0.000000E+00	0.000000E+00
QC	5	0.325694E-01	0.112615E-05	0.216122E-01	0.000000E+00	0.000000E+00	0.000000E+00
ROUPING	5	0.324460E-01	0.988561E-06	0.213830E-01	0.000000E+00	0.000000E+00	0.000000E+00
0 %	5	0.324460E-01	0.990640E-06	0.213830E-01	0.000000E+00	0.000000E+00	0.000000E+00
OUBLE SUM	5	0.326382E-01	0.114297E-05	0.217175E-01	0.000000E+00	0.000000E+00	0.000000E+00

spatial combination B (R=R1+0.4R2+0.4R3)

RSS	5	0.324453E-01	0.389978E-06	0.855303E-02	0.000000E+00	0.000000E+00	0.000000E+00
QC	5	0.325694E-01	0.450461E-06	0.864488E-02	0.000000E+00	0.000000E+00	0.000000E+00
ROUPING	5	0.324460E-01	0.395425E-06	0.855318E-02	0.000000E+00	0.000000E+00	0.000000E+00
10 %	5	0.324460E-01	0.396256E-06	0.855318E-02	0.000000E+00	0.000000E+00	0.000000E+00
OUBLE SUM	5	0.326382E-01	0.457188E-06	0.868698E-02	0.000000E+00	0.000000E+00	0.000000E+00

spatial combination C (R=0.4R1+R2+0.4R3)

RSS	5	0.129781E-01	0.974944E-06	0.855303E-02	0.000000E+00	0.000000E+00	0.000000E+00
QC	5	0.130277E-01	0.112615E-05	0.864488E-02	0.000000E+00	0.000000E+00	0.000000E+00
ROUPING	5	0.129784E-01	0.988561E-06	0.855318E-02	0.000000E+00	0.000000E+00	0.000000E+00
10 %	5	0.129784E-01	0.990640E-06	0.855318E-02	0.000000E+00	0.000000E+00	0.000000E+00
OUBLE SUM	5	0.130553E-01	0.114297E-05	0.868698E-02	0.000000E+00	0.000000E+00	0.000000E+00

spatial combination D (R=0.4R1+0.4R2+R3)

RSS	5	0.129781E-01	0.389978E-06	0.213826E-01	0.000000E+00	0.000000E+00	0.000000E+00
QC	5	0.130277E-01	0.450461E-06	0.216122E-01	0.000000E+00	0.000000E+00	0.000000E+00
ROUPING	5	0.129784E-01	0.395425E-06	0.213830E-01	0.000000E+00	0.000000E+00	0.000000E+00
10 %	5	0.129784E-01	0.396256E-06	0.213830E-01	0.000000E+00	0.000000E+00	0.000000E+00
OUBLE SUM	5	0.130553E-01	0.457188E-06	0.217175E-01	0.000000E+00	0.000000E+00	0.000000E+00

NODE = 19

spatial combination A (srss)

method	node	Ux	Uy	Uz	Rxx	Ryy	Rzz
SRSS	19	0.125542E-01	0.209502E-06	0.925266E-02	0.000000E+00	0.000000E+00	0.000000E+00
CQC	19	0.127415E-01	0.175233E-06	0.937766E-02	0.000000E+00	0.000000E+00	0.000000E+00
GROUPING	19	0.125563E-01	0.215547E-06	0.925478E-02	0.000000E+00	0.000000E+00	0.000000E+00
10 %	19	0.125563E-01	0.215703E-06	0.925478E-02	0.000000E+00	0.000000E+00	0.000000E+00
DOUBLE SUM	19	0.127783E-01	0.250219E-06	0.943187E-02	0.000000E+00	0.000000E+00	0.000000E+00

spatial combination B (R=R1+0.4R2+0.4R3)

method	node	Ux	Uy	Uz	Rxx	Ryy	Rzz
SRSS	19	0.125542E-01	0.838008E-07	0.370107E-02	0.000000E+00	0.000000E+00	0.000000E+00
CQC	19	0.127415E-01	0.700930E-07	0.375107E-02	0.000000E+00	0.000000E+00	0.000000E+00
GROUPING	19	0.125563E-01	0.862189E-07	0.370191E-02	0.000000E+00	0.000000E+00	0.000000E+00
10 %	19	0.125563E-01	0.862811E-07	0.370191E-02	0.000000E+00	0.000000E+00	0.000000E+00
DOUBLE SUM	19	0.127783E-01	0.100088E-06	0.377275E-02	0.000000E+00	0.000000E+00	0.000000E+00

spatial combination C (R=0.4R1+R2+0.4R3)

method	node	Ux	Uy	Uz	Rxx	Ryy	Rzz
SRSS	19	0.502166E-02	0.209502E-06	0.370107E-02	0.000000E+00	0.000000E+00	0.000000E+00
CQC	19	0.509659E-02	0.175233E-06	0.375107E-02	0.000000E+00	0.000000E+00	0.000000E+00
GROUPING	19	0.502253E-02	0.215547E-06	0.370191E-02	0.000000E+00	0.000000E+00	0.000000E+00
10 %	19	0.502253E-02	0.215703E-06	0.370191E-02	0.000000E+00	0.000000E+00	0.000000E+00
DOUBLE SUM	19	0.511131E-02	0.250219E-06	0.377275E-02	0.000000E+00	0.000000E+00	0.000000E+00

spatial combination D (R=0.4R1+0.4R2+R3)

method	node	Ux	Uy	Uz	Rxx	Ryy	Rzz
SRSS	19	0.502166E-02	0.838008E-07	0.925266E-02	0.000000E+00	0.000000E+00	0.000000E+00
CQC	19	0.509659E-02	0.700930E-07	0.937766E-02	0.000000E+00	0.000000E+00	0.000000E+00
GROUPING	19	0.502253E-02	0.862189E-07	0.925478E-02	0.000000E+00	0.000000E+00	0.000000E+00
10 %	19	0.502253E-02	0.862811E-07	0.925478E-02	0.000000E+00	0.000000E+00	0.000000E+00
DOUBLE SUM	19	0.511131E-02	0.100088E-06	0.943187E-02	0.000000E+00	0.000000E+00	0.000000E+00

NODE = 22

spatial combination A (srss)

method	node	Ux	Uy	Uz	Rxx	Ryy	Rzz

SRSS	22	0.398564E-02	0.468629E-06	0.881064E-02	0.000000E+00	0.000000E+00	0.000000E+00
CQC	22	0.401748E-02	0.541240E-06	0.893139E-02	0.000000E+00	0.000000E+00	0.000000E+00
GROUPING	22	0.398848E-02	0.475335E-06	0.881287E-02	0.000000E+00	0.000000E+00	0.000000E+00
10 %	22	0.398848E-02	0.476283E-06	0.881287E-02	0.000000E+00	0.000000E+00	0.000000E+00
DOUBLE SUM	22	0.402640E-02	0.549283E-06	0.898351E-02	0.000000E+00	0.000000E+00	0.000000E+00

spatial combination B (R=R1+0.4R2+0.4R3)

SRSS	22	0.398564E-02	0.187452E-06	0.352425E-02	0.000000E+00	0.000000E+00	0.000000E+00
CQC	22	0.401748E-02	0.216496E-06	0.357256E-02	0.000000E+00	0.000000E+00	0.000000E+00
GROUPING	22	0.398848E-02	0.190134E-06	0.352515E-02	0.000000E+00	0.000000E+00	0.000000E+00
10 %	22	0.398848E-02	0.190513E-06	0.352515E-02	0.000000E+00	0.000000E+00	0.000000E+00
DOUBLE SUM	22	0.402640E-02	0.219713E-06	0.359340E-02	0.000000E+00	0.000000E+00	0.000000E+00

spatial combination C (R=0.4R1+R2+0.4R3)

SRSS	22	0.159426E-02	0.468629E-06	0.352425E-02	0.000000E+00	0.000000E+00	0.000000E+00
CQC	22	0.160699E-02	0.541240E-06	0.357256E-02	0.000000E+00	0.000000E+00	0.000000E+00
GROUPING	22	0.159539E-02	0.475335E-06	0.352515E-02	0.000000E+00	0.000000E+00	0.000000E+00
10 %	22	0.159539E-02	0.476283E-06	0.352515E-02	0.000000E+00	0.000000E+00	0.000000E+00
DOUBLE SUM	22	0.161056E-02	0.549283E-06	0.359340E-02	0.000000E+00	0.000000E+00	0.000000E+00

spatial combination D (R=0.4R1+0.4R2+R3)

SRSS	22	0.159426E-02	0.187452E-06	0.881064E-02	0.000000E+00	0.000000E+00	0.000000E+00
CQC	22	0.160699E-02	0.216496E-06	0.893139E-02	0.000000E+00	0.000000E+00	0.000000E+00
GROUPING	22	0.159539E-02	0.190134E-06	0.881287E-02	0.000000E+00	0.000000E+00	0.000000E+00
10 %	22	0.159539E-02	0.190513E-06	0.881287E-02	0.000000E+00	0.000000E+00	0.000000E+00
DOUBLE SUM	22	0.161056E-02	0.219713E-06	0.898351E-02	0.000000E+00	0.000000E+00	0.000000E+00

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ELEMENT FORCES IN GLOBAL BY R.S.T. OF BUILD. 1

ELEMENT = 1

spatial combination A (srss)

method	node	Fx	Fy	Fz	Mxx	Myy	Mzz
SRSS	1	0.125519E+04	0.130563E+02	0.478044E+05	0.000000E+00	0.143411E+06	0.391700E+02
	2	0.125519E+04	0.130563E+02	0.478044E+05	0.000000E+00	0.143411E+06	0.391700E+02
CQC	1	0.121817E+04	0.150967E+02	0.466996E+05	0.000000E+00	0.140096E+06	0.452916E+02
	2	0.121817E+04	0.150967E+02	0.466996E+05	0.000000E+00	0.140096E+06	0.452916E+02
GROUPING	1	0.125597E+04	0.137984E+02	0.478584E+05	0.000000E+00	0.143573E+06	0.413965E+02
	2	0.125597E+04	0.137984E+02	0.478584E+05	0.000000E+00	0.143573E+06	0.413965E+02
10 %	1	0.125600E+04	0.138274E+02	0.478584E+05	0.000000E+00	0.143573E+06	0.414836E+02
	2	0.125600E+04	0.138274E+02	0.478584E+05	0.000000E+00	0.143573E+06	0.414836E+02
DOUBLE SUM	1	0.130884E+04	0.152386E+02	0.529244E+05	0.000000E+00	0.158771E+06	0.457171E+02
	2	0.130884E+04	0.152386E+02	0.529244E+05	0.000000E+00	0.158771E+06	0.457171E+02

spatial combination B (R=R1+0.4R2+0.4R3)

method	node	Fx	Fy	Fz	Mxx	Myy	Mzz
SRSS	1	0.125519E+04	0.522251E+01	0.191218E+05	0.000000E+00	0.573643E+05	0.156680E+02
	2	0.125519E+04	0.522251E+01	0.191218E+05	0.000000E+00	0.573643E+05	0.156680E+02
CQC	1	0.121817E+04	0.603869E+01	0.186798E+05	0.000000E+00	0.560386E+05	0.181166E+02
	2	0.121817E+04	0.603869E+01	0.186798E+05	0.000000E+00	0.560386E+05	0.181166E+02
GROUPING	1	0.125597E+04	0.551937E+01	0.191434E+05	0.000000E+00	0.574291E+05	0.165586E+02
	2	0.125597E+04	0.551937E+01	0.191434E+05	0.000000E+00	0.574291E+05	0.165586E+02
10 %	1	0.125600E+04	0.553097E+01	0.191434E+05	0.000000E+00	0.574291E+05	0.165934E+02
	2	0.125600E+04	0.553097E+01	0.191434E+05	0.000000E+00	0.574291E+05	0.165934E+02
DOUBLE SUM	1	0.130884E+04	0.609542E+01	0.211697E+05	0.000000E+00	0.635082E+05	0.182868E+02
	2	0.130884E+04	0.609542E+01	0.211697E+05	0.000000E+00	0.635082E+05	0.182868E+02

spatial combination C (R=0.4R1+R2+0.4R3)

method	node	Fx	Fy	Fz	Mxx	Myy	Mzz
SRSS	1	0.502075E+03	0.130563E+02	0.191218E+05	0.000000E+00	0.573643E+05	0.391700E+02
	2	0.502075E+03	0.130563E+02	0.191218E+05	0.000000E+00	0.573643E+05	0.391700E+02
CQC	1	0.487268E+03	0.150967E+02	0.186798E+05	0.000000E+00	0.560386E+05	0.452916E+02
	2	0.487268E+03	0.150967E+02	0.186798E+05	0.000000E+00	0.560386E+05	0.452916E+02
GROUPING	1	0.502388E+03	0.137984E+02	0.191434E+05	0.000000E+00	0.574291E+05	0.413965E+02
	2	0.502388E+03	0.137984E+02	0.191434E+05	0.000000E+00	0.574291E+05	0.413965E+02
10 %	1	0.502398E+03	0.138274E+02	0.191434E+05	0.000000E+00	0.574291E+05	0.414836E+02
	2	0.502398E+03	0.138274E+02	0.191434E+05	0.000000E+00	0.574291E+05	0.414836E+02
DOUBLE SUM	1	0.523537E+03	0.152386E+02	0.211697E+05	0.000000E+00	0.635082E+05	0.457171E+02
	2	0.523537E+03	0.152386E+02	0.211697E+05	0.000000E+00	0.635082E+05	0.457171E+02

spatial combination D (R=0.4R1+0.4R2+R3)

	2	0.502075E+03	0.522251E+01	0.478044E+05	0.000000E+00	0.143411E+06	0.156680E+02
:QC	1	0.487268E+03	0.603869E+01	0.466996E+05	0.000000E+00	0.140096E+06	0.181166E+02
	2	0.487268E+03	0.603869E+01	0.466996E+05	0.000000E+00	0.140096E+06	0.181166E+02
;ROUPING	1	0.502388E+03	0.551937E+01	0.478584E+05	0.000000E+00	0.143573E+06	0.165586E+02
	2	0.502388E+03	0.551937E+01	0.478584E+05	0.000000E+00	0.143573E+06	0.165586E+02
.0 %	1	0.502398E+03	0.553097E+01	0.478584E+05	0.000000E+00	0.143573E+06	0.165934E+02
	2	0.502398E+03	0.553097E+01	0.478584E+05	0.000000E+00	0.143573E+06	0.165934E+02
)OUBLE SUM	1	0.523537E+03	0.609542E+01	0.529244E+05	0.000000E+00	0.158771E+06	0.182868E+02
	2	0.523537E+03	0.609542E+01	0.529244E+05	0.000000E+00	0.158771E+06	0.182868E+02

ELEMENT = 9

spatial combination A (srss)

ıethod	node	Fx	Fy	Fz	Mxx	Myy	Mzz
;RSS	5	0.135323E+04	0.125396E+02	0.439086E+05	0.000000E+00	0.131724E+06	0.376201E+02
	6	0.135323E+04	0.125396E+02	0.439086E+05	0.000000E+00	0.131724E+06	0.376201E+02
:QC	5	0.137537E+04	0.144715E+02	0.430346E+05	0.000000E+00	0.129102E+06	0.434158E+02
	6	0.137537E+04	0.144715E+02	0.430346E+05	0.000000E+00	0.129102E+06	0.434158E+02
;ROUPING	5	0.139139E+04	0.132308E+02	0.439339E+05	0.000000E+00	0.131800E+06	0.396936E+02
	6	0.139139E+04	0.132308E+02	0.439339E+05	0.000000E+00	0.131800E+06	0.396936E+02
.0 %	5	0.139196E+04	0.132559E+02	0.439339E+05	0.000000E+00	0.131800E+06	0.397689E+02
	6	0.139196E+04	0.132559E+02	0.439339E+05	0.000000E+00	0.131800E+06	0.397689E+02
)OUBLE SUM	5	0.150265E+04	0.146046E+02	0.484270E+05	0.000000E+00	0.145279E+06	0.438150E+02
	6	0.150265E+04	0.146046E+02	0.484270E+05	0.000000E+00	0.145279E+06	0.438150E+02

spatial combination B (R=R1+0.4R2+0.4R3)

;RSS	5	0.135323E+04	0.501586E+01	0.175634E+05	0.000000E+00	0.526894E+05	0.150480E+02
	6	0.135323E+04	0.501586E+01	0.175634E+05	0.000000E+00	0.526894E+05	0.150480E+02
:QC	5	0.137537E+04	0.578860E+01	0.172139E+05	0.000000E+00	0.516407E+05	0.173663E+02
	6	0.137537E+04	0.578860E+01	0.172139E+05	0.000000E+00	0.516407E+05	0.173663E+02
;ROUPING	5	0.139139E+04	0.529232E+01	0.175736E+05	0.000000E+00	0.527199E+05	0.158774E+02
	6	0.139139E+04	0.529232E+01	0.175736E+05	0.000000E+00	0.527199E+05	0.158774E+02
.0 %	5	0.139196E+04	0.530236E+01	0.175736E+05	0.000000E+00	0.527199E+05	0.159076E+02
	6	0.139196E+04	0.530236E+01	0.175736E+05	0.000000E+00	0.527199E+05	0.159076E+02
)OUBLE SUM	5	0.150265E+04	0.584182E+01	0.193708E+05	0.000000E+00	0.581115E+05	0.175260E+02
	6	0.150265E+04	0.584182E+01	0.193708E+05	0.000000E+00	0.581115E+05	0.175260E+02

spatial combination C (R=0.4R1+R2+0.4R3)

;RSS	5	0.541293E+03	0.125396E+02	0.175634E+05	0.000000E+00	0.526894E+05	0.376201E+02
	6	0.541293E+03	0.125396E+02	0.175634E+05	0.000000E+00	0.526894E+05	0.376201E+02
:QC	5	0.550148E+03	0.144715E+02	0.172139E+05	0.000000E+00	0.516407E+05	0.434158E+02
	6	0.550148E+03	0.144715E+02	0.172139E+05	0.000000E+00	0.516407E+05	0.434158E+02
;ROUPING	5	0.556556E+03	0.132308E+02	0.175736E+05	0.000000E+00	0.527199E+05	0.396936E+02

	6	0.556556E+03	0.132308E+02	0.175736E+05	0.000000E+00	0.527199E+05	0.397636E+02
10 %	5	0.556784E+03	0.132559E+02	0.175736E+05	0.000000E+00	0.527199E+05	0.397689E+02
	6	0.556784E+03	0.132559E+02	0.175736E+05	0.000000E+00	0.527199E+05	0.397689E+02
DOUBLE SUM	5	0.601058E+03	0.146046E+02	0.193708E+05	0.000000E+00	0.581115E+05	0.438150E+02
	6	0.601058E+03	0.146046E+02	0.193708E+05	0.000000E+00	0.581115E+05	0.438150E+02

spatial combination D (R=0.4R1+0.4R2+R3)

SRSS	5	0.541293E+03	0.501586E+01	0.439086E+05	0.000000E+00	0.131724E+06	0.150480E+02
	6	0.541293E+03	0.501586E+01	0.439086E+05	0.000000E+00	0.131724E+06	0.150480E+02
CQC	5	0.550148E+03	0.578860E+01	0.430346E+05	0.000000E+00	0.129102E+06	0.173663E+02
	6	0.550148E+03	0.578860E+01	0.430346E+05	0.000000E+00	0.129102E+06	0.173663E+02
GROUPING	5	0.556556E+03	0.529232E+01	0.439339E+05	0.000000E+00	0.131800E+06	0.158774E+02
	6	0.556556E+03	0.529232E+01	0.439339E+05	0.000000E+00	0.131800E+06	0.158774E+02
10 %	5	0.556784E+03	0.530236E+01	0.439339E+05	0.000000E+00	0.131800E+06	0.159076E+02
	6	0.556784E+03	0.530236E+01	0.439339E+05	0.000000E+00	0.131800E+06	0.159076E+02
DOUBLE SUM	5	0.601058E+03	0.584182E+01	0.484270E+05	0.000000E+00	0.145279E+06	0.175260E+02
	6	0.601058E+03	0.584182E+01	0.484270E+05	0.000000E+00	0.145279E+06	0.175260E+02

ELEMENT = 39
spatial combination A (srss)

method	node	Fx	Fy	Fz	Mxx	Myy	Mzz
SRSS	19	0.183032E+05	0.191002E+01	0.265531E+06	0.477504E+01	0.457589E+05	0.000000E+00
	22	0.183032E+05	0.191002E+01	0.265531E+06	0.477504E+01	0.457589E+05	0.000000E+00
CQC	19	0.186400E+05	0.207887E+01	0.268227E+06	0.519718E+01	0.466007E+05	0.000000E+00
	22	0.186400E+05	0.207887E+01	0.268227E+06	0.519718E+01	0.466007E+05	0.000000E+00
GROUPING	19	0.183035E+05	0.198450E+01	0.265535E+06	0.496125E+01	0.457597E+05	0.000000E+00
	22	0.183035E+05	0.198450E+01	0.265535E+06	0.496125E+01	0.457597E+05	0.000000E+00
10 %	19	0.183036E+05	0.198873E+01	0.265535E+06	0.497183E+01	0.457597E+05	0.000000E+00
	22	0.183036E+05	0.198873E+01	0.265535E+06	0.497183E+01	0.457597E+05	0.000000E+00
DOUBLE SUM	19	0.187161E+05	0.223067E+01	0.269525E+06	0.557668E+01	0.467910E+05	0.000000E+00
	22	0.187161E+05	0.223067E+01	0.269525E+06	0.557668E+01	0.467910E+05	0.000000E+00

spatial combination B (R=R1+0.4R2+0.4R3)

SRSS	19	0.183032E+05	0.764007E+00	0.106212E+06	0.191002E+01	0.457589E+05	0.000000E+00
	22	0.183032E+05	0.764007E+00	0.106212E+06	0.191002E+01	0.457589E+05	0.000000E+00
CQC	19	0.186400E+05	0.831550E+00	0.107291E+06	0.207887E+01	0.466007E+05	0.000000E+00
	22	0.186400E+05	0.831550E+00	0.107291E+06	0.207887E+01	0.466007E+05	0.000000E+00
GROUPING	19	0.183035E+05	0.793800E+00	0.106214E+06	0.198450E+01	0.457597E+05	0.000000E+00
	22	0.183035E+05	0.793800E+00	0.106214E+06	0.198450E+01	0.457597E+05	0.000000E+00
10 %	19	0.183036E+05	0.795493E+00	0.106214E+06	0.198873E+01	0.457597E+05	0.000000E+00
	22	0.183036E+05	0.795493E+00	0.106214E+06	0.198873E+01	0.457597E+05	0.000000E+00
DOUBLE SUM	19	0.187161E+05	0.892268E+00	0.107810E+06	0.223067E+01	0.467910E+05	0.000000E+00
	22	0.187161E+05	0.892268E+00	0.107810E+06	0.223067E+01	0.467910E+05	0.000000E+00

spatial combination C (R=0.4R1+R2+0.4R3)

SRSS	19	0.732129E+04	0.191002E+01	0.106212E+06	0.477504E+01	0.183036E+05	0.000000E+00
	22	0.732129E+04	0.191002E+01	0.106212E+06	0.477504E+01	0.183036E+05	0.000000E+00
CQC	19	0.745598E+04	0.207887E+01	0.107291E+06	0.519718E+01	0.186403E+05	0.000000E+00
	22	0.745598E+04	0.207887E+01	0.107291E+06	0.519718E+01	0.186403E+05	0.000000E+00
GROUPING	19	0.732142E+04	0.198450E+01	0.106214E+06	0.496125E+01	0.183039E+05	0.000000E+00
	22	0.732142E+04	0.198450E+01	0.106214E+06	0.496125E+01	0.183039E+05	0.000000E+00
10 %	19	0.732142E+04	0.198873E+01	0.106214E+06	0.497183E+01	0.183039E+05	0.000000E+00
	22	0.732142E+04	0.198873E+01	0.106214E+06	0.497183E+01	0.183039E+05	0.000000E+00
DOUBLE SUM	19	0.748642E+04	0.223067E+01	0.107810E+06	0.557668E+01	0.187164E+05	0.000000E+00
	22	0.748642E+04	0.223067E+01	0.107810E+06	0.557668E+01	0.187164E+05	0.000000E+00

spatial combination D (R=0.4R1+0.4R2+R3)

SRSS	19	0.732129E+04	0.764007E+00	0.265531E+06	0.191002E+01	0.183036E+05	0.000000E+00
	22	0.732129E+04	0.764007E+00	0.265531E+06	0.191002E+01	0.183036E+05	0.000000E+00
CQC	19	0.745598E+04	0.831550E+00	0.268227E+06	0.207887E+01	0.186403E+05	0.000000E+00
	22	0.745598E+04	0.831550E+00	0.268227E+06	0.207887E+01	0.186403E+05	0.000000E+00
GROUPING	19	0.732142E+04	0.793800E+00	0.265535E+06	0.198450E+01	0.183039E+05	0.000000E+00
	22	0.732142E+04	0.793800E+00	0.265535E+06	0.198450E+01	0.183039E+05	0.000000E+00
10 %	19	0.732142E+04	0.795493E+00	0.265535E+06	0.198873E+01	0.183039E+05	0.000000E+00
	22	0.732142E+04	0.795493E+00	0.265535E+06	0.198873E+01	0.183039E+05	0.000000E+00
DOUBLE SUM	19	0.748642E+04	0.892268E+00	0.269525E+06	0.223067E+01	0.187164E+05	0.000000E+00
	22	0.748642E+04	0.892268E+00	0.269525E+06	0.223067E+01	0.187164E+05	0.000000E+00

ELEMENT = 47

spatial combination A (srss)

method	node	Fx	Fy	Fz	Mxx	Myy	Mzz
SRSS	30	0.139553E+06	0.790811E+03	0.179640E+06	0.359271E+06	0.000000E+00	0.279110E+06
	22	0.139553E+06	0.790811E+03	0.179640E+06	0.359271E+06	0.000000E+00	0.279110E+06
CQC	30	0.140668E+06	0.913343E+03	0.182102E+06	0.364195E+06	0.000000E+00	0.281340E+06
	22	0.140668E+06	0.913343E+03	0.182102E+06	0.364195E+06	0.000000E+00	0.281340E+06
GROUPING	30	0.139653E+06	0.802128E+03	0.179686E+06	0.359362E+06	0.000000E+00	0.279309E+06
	22	0.139653E+06	0.802128E+03	0.179686E+06	0.359362E+06	0.000000E+00	0.279309E+06
10 %	30	0.139653E+06	0.803728E+03	0.179686E+06	0.359362E+06	0.000000E+00	0.279309E+06
	22	0.139653E+06	0.803728E+03	0.179686E+06	0.359362E+06	0.000000E+00	0.279309E+06
DOUBLE SUM	30	0.140980E+06	0.926915E+03	0.183165E+06	0.366321E+06	0.000000E+00	0.281964E+06
	22	0.140980E+06	0.926915E+03	0.183165E+06	0.366321E+06	0.000000E+00	0.281964E+06

spatial combination B (R=R1+0.4R2+0.4R3)

SRSS	30	0.139553E+06	0.316325E+03	0.718560E+05	0.143709E+06	0.000000E+00	0.279110E+06
	22	0.139553E+06	0.316325E+03	0.718560E+05	0.143709E+06	0.000000E+00	0.279110E+06

CQC	30	0.140668E+06	0.365337E+03	0.728409E+05	0.145678E+06	0.000000E+00	0.281340E+06
	22	0.140668E+06	0.365337E+03	0.728409E+05	0.145678E+06	0.000000E+00	0.281340E+06
GROUPING	30	0.139653E+06	0.320851E+03	0.718742E+05	0.143745E+06	0.000000E+00	0.279309E+06
	22	0.139653E+06	0.320851E+03	0.718742E+05	0.143745E+06	0.000000E+00	0.279309E+06
10 %	30	0.139653E+06	0.321491E+03	0.718742E+05	0.143745E+06	0.000000E+00	0.279309E+06
	22	0.139653E+06	0.321491E+03	0.718742E+05	0.143745E+06	0.000000E+00	0.279309E+06
DOUBLE SUM	30	0.140980E+06	0.370766E+03	0.732659E+05	0.146528E+06	0.000000E+00	0.281964E+06
	22	0.140980E+06	0.370766E+03	0.732659E+05	0.146528E+06	0.000000E+00	0.281964E+06

spatial combination C (R=0.4R1+R2+0.4R3)

SRSS	30	0.558213E+05	0.790811E+03	0.718560E+05	0.143709E+06	0.000000E+00	0.111644E+06
	22	0.558213E+05	0.790811E+03	0.718560E+05	0.143709E+06	0.000000E+00	0.111644E+06
CQC	30	0.562672E+05	0.913343E+03	0.728409E+05	0.145678E+06	0.000000E+00	0.112536E+06
	22	0.562672E+05	0.913343E+03	0.728409E+05	0.145678E+06	0.000000E+00	0.112536E+06
GROUPING	30	0.558611E+05	0.802128E+03	0.718742E+05	0.143745E+06	0.000000E+00	0.111724E+06
	22	0.558611E+05	0.802128E+03	0.718742E+05	0.143745E+06	0.000000E+00	0.111724E+06
10 %	30	0.558611E+05	0.803728E+03	0.718742E+05	0.143745E+06	0.000000E+00	0.111724E+06
	22	0.558611E+05	0.803728E+03	0.718742E+05	0.143745E+06	0.000000E+00	0.111724E+06
DOUBLE SUM	30	0.563921E+05	0.926915E+03	0.732659E+05	0.146528E+06	0.000000E+00	0.112786E+06
	22	0.563921E+05	0.926915E+03	0.732659E+05	0.146528E+06	0.000000E+00	0.112786E+06

spatial combination D (R=0.4R1+0.4R2+R3)

SRSS	30	0.558213E+05	0.316325E+03	0.179640E+06	0.359271E+06	0.000000E+00	0.111644E+06
	22	0.558213E+05	0.316325E+03	0.179640E+06	0.359271E+06	0.000000E+00	0.111644E+06
CQC	30	0.562672E+05	0.365337E+03	0.182102E+06	0.364195E+06	0.000000E+00	0.112536E+06
	22	0.562672E+05	0.365337E+03	0.182102E+06	0.364195E+06	0.000000E+00	0.112536E+06
GROUPING	30	0.558611E+05	0.320851E+03	0.179686E+06	0.359362E+06	0.000000E+00	0.111724E+06
	22	0.558611E+05	0.320851E+03	0.179686E+06	0.359362E+06	0.000000E+00	0.111724E+06
10 %	30	0.558611E+05	0.321491E+03	0.179686E+06	0.359362E+06	0.000000E+00	0.111724E+06
	22	0.558611E+05	0.321491E+03	0.179686E+06	0.359362E+06	0.000000E+00	0.111724E+06
DOUBLE SUM	30	0.563921E+05	0.370766E+03	0.183165E+06	0.366321E+06	0.000000E+00	0.112786E+06
	22	0.563921E+05	0.370766E+03	0.183165E+06	0.366321E+06	0.000000E+00	0.112786E+06

TABLE - 7

NODAL DISP. BY THA OF BUILDING 1

method	node	Ux	Uy	Uz	Rxx	Ryy	Rzz
SRSS	1	0.361692E-01	0.140053E-05	0.277437E-01	0.000000E+00	0.000000E+00	0.000000E+00
SRSS	5	0.321463E-01	0.134178E-05	0.219021E-01	0.000000E+00	0.000000E+00	0.000000E+00
SRSS	19	0.126811E-01	0.208870E-06	0.967807E-02	0.000000E+00	0.000000E+00	0.000000E+00
SRSS	22	0.399509E-02	0.641229E-06	0.922479E-02	0.000000E+00	0.000000E+00	0.000000E+00

FORCES in global by T.H.A. OF BUILD. 1

method	node	Fx	Fy	Fz	Mxx	Myy	Mzz
	Element 1						
SRSS	1	0.128504E+04	0.174547E+02	0.401727E+05	0.000000E+00	0.120516E+06	0.523657E+02
	2	0.128504E+04	0.174547E+02	0.401727E+05	0.000000E+00	0.120516E+06	0.523657E+02
	Element 9						
SRSS	5	0.155142E+04	0.166455E+02	0.363499E+05	0.000000E+00	0.109048E+06	0.499382E+02
	6	0.155142E+04	0.166455E+02	0.363499E+05	0.000000E+00	0.109048E+06	0.499382E+02
	Element 39						
SRSS	19	0.185116E+05	0.250602E+01	0.272133E+06	0.626504E+01	0.462798E+05	0.000000E+00
	22	0.185116E+05	0.250602E+01	0.272133E+06	0.626504E+01	0.462798E+05	0.000000E+00
	Element 47						
SRSS	30	0.139884E+06	0.108208E+04	0.188084E+06	0.376159E+06	0.000000E+00	0.279772E+06
	22	0.139884E+06	0.108208E+04	0.188084E+06	0.376159E+06	0.000000E+00	0.279772E+06

TABLE 8

ERRORS IN RESPONSE BY R.S.T. FOR BUILDING 1

Errors in disp. of build. 1

method	node	Ux	Uy	Uz			
SPATIAL COMB 1							
SRSS	1	0.9431E-02	-0.2768E+00	-0.1817E-01	0.0000E+00	0.0000E+00	0.0000E+00
CQC	1	0.1360E-01	-0.1642E+00	-0.8110E-02	0.0000E+00	0.0000E+00	0.0000E+00
GROUPING	1	0.9528E-02	-0.2665E+00	-0.1810E-01	0.0000E+00	0.0000E+00	0.0000E+00
10 %	1	0.9528E-02	-0.2649E+00	-0.1810E-01	0.0000E+00	0.0000E+00	0.0000E+00
DOUBLE SUM	1	0.1573E-01	-0.1518E+00	-0.3341E-02	0.0000E+00	0.0000E+00	0.0000E+00
SPATIAL COMB 2							
SRSS	1	0.9431E-02	-0.7107E+00	-0.6073E+00	0.0000E+00	0.0000E+00	0.0000E+00
CQC	1	0.1360E-01	-0.6657E+00	-0.6032E+00	0.0000E+00	0.0000E+00	0.0000E+00
GROUPING	1	0.9528E-02	-0.7066E+00	-0.6072E+00	0.0000E+00	0.0000E+00	0.0000E+00
10 %	1	0.9528E-02	-0.7060E+00	-0.6072E+00	0.0000E+00	0.0000E+00	0.0000E+00
DOUBLE SUM	1	0.1573E-01	-0.6607E+00	-0.6013E+00	0.0000E+00	0.0000E+00	0.0000E+00
SPATIAL COMB 3							
SRSS	1	-0.5962E+00	-0.2768E+00	-0.6073E+00	0.0000E+00	0.0000E+00	0.0000E+00
CQC	1	-0.5946E+00	-0.1642E+00	-0.6032E+00	0.0000E+00	0.0000E+00	0.0000E+00
GROUPING	1	-0.5962E+00	-0.2665E+00	-0.6072E+00	0.0000E+00	0.0000E+00	0.0000E+00
10 %	1	-0.5962E+00	-0.2649E+00	-0.6072E+00	0.0000E+00	0.0000E+00	0.0000E+00
DOUBLE SUM	1	-0.5937E+00	-0.1518E+00	-0.6013E+00	0.0000E+00	0.0000E+00	0.0000E+00
SPATIAL COMB 4							
SRSS	1	-0.5962E+00	-0.7107E+00	-0.1817E-01	0.0000E+00	0.0000E+00	0.0000E+00
CQC	1	-0.5946E+00	-0.6657E+00	-0.8110E-02	0.0000E+00	0.0000E+00	0.0000E+00
GROUPING	1	-0.5962E+00	-0.7066E+00	-0.1810E-01	0.0000E+00	0.0000E+00	0.0000E+00
10 %	1	-0.5962E+00	-0.7060E+00	-0.1810E-01	0.0000E+00	0.0000E+00	0.0000E+00
DOUBLE SUM	1	-0.5937E+00	-0.6607E+00	-0.3341E-02	0.0000E+00	0.0000E+00	0.0000E+00
SPATIAL COMB 1							
SRSS	5	0.9301E-02	-0.2734E+00	-0.2372E-01	0.0000E+00	0.0000E+00	0.0000E+00
CQC	5	0.1316E-01	-0.1607E+00	-0.1324E-01	0.0000E+00	0.0000E+00	0.0000E+00
GROUPING	5	0.9323E-02	-0.2633E+00	-0.2370E-01	0.0000E+00	0.0000E+00	0.0000E+00
10 %	5	0.9323E-02	-0.2617E+00	-0.2370E-01	0.0000E+00	0.0000E+00	0.0000E+00
DOUBLE SUM	5	0.1530E-01	-0.1482E+00	-0.8428E-02	0.0000E+00	0.0000E+00	0.0000E+00

SPATIAL COMB 2

SRSS	5	0.9301E-02	-0.7094E+00	-0.6095E+00	0.0000E+00	0.0000E+00	0.0000E+00
CQC	5	0.1316E-01	-0.6643E+00	-0.6053E+00	0.0000E+00	0.0000E+00	0.0000E+00
GROUPING	5	0.9323E-02	-0.7053E+00	-0.6095E+00	0.0000E+00	0.0000E+00	0.0000E+00
10 %	5	0.9323E-02	-0.7047E+00	-0.6095E+00	0.0000E+00	0.0000E+00	0.0000E+00
DOUBLE SUM	5	0.1530E-01	-0.6593E+00	-0.6034E+00	0.0000E+00	0.0000E+00	0.0000E+00

SPATIAL COMB 3

SRSS	5	-0.5963E+00	-0.2734E+00	-0.6095E+00	0.0000E+00	0.0000E+00	0.0000E+00
CQC	5	-0.5947E+00	-0.1607E+00	-0.6053E+00	0.0000E+00	0.0000E+00	0.0000E+00
GROUPING	5	-0.5963E+00	-0.2633E+00	-0.6095E+00	0.0000E+00	0.0000E+00	0.0000E+00
10 %	5	-0.5963E+00	-0.2617E+00	-0.6095E+00	0.0000E+00	0.0000E+00	0.0000E+00
DOUBLE SUM	5	-0.5939E+00	-0.1482E+00	-0.6034E+00	0.0000E+00	0.0000E+00	0.0000E+00

SPATIAL COMB 4

SRSS	5	-0.5963E+00	-0.7094E+00	-0.2372E-01	0.0000E+00	0.0000E+00	0.0000E+00
CQC	5	-0.5947E+00	-0.6643E+00	-0.1324E-01	0.0000E+00	0.0000E+00	0.0000E+00
GROUPING	5	-0.5963E+00	-0.7053E+00	-0.2370E-01	0.0000E+00	0.0000E+00	0.0000E+00
10 %	5	-0.5963E+00	-0.7047E+00	-0.2370E-01	0.0000E+00	0.0000E+00	0.0000E+00
DOUBLE SUM	5	-0.5939E+00	-0.6593E+00	-0.8428E-02	0.0000E+00	0.0000E+00	0.0000E+00

SPATIAL COMB 1

SRSS	19	-0.1001E-01	0.3026E-02	-0.4396E-01	0.0000E+00	0.0000E+00	0.0000E+00
CQC	19	0.4763E-02	-0.1610E+00	-0.3104E-01	0.0000E+00	0.0000E+00	0.0000E+00
GROUPING	19	-0.9841E-02	0.3197E-01	-0.4374E-01	0.0000E+00	0.0000E+00	0.0000E+00
10 %	19	-0.9841E-02	0.3271E-01	-0.4374E-01	0.0000E+00	0.0000E+00	0.0000E+00
DOUBLE SUM	19	0.7665E-02	0.1980E+00	-0.2544E-01	0.0000E+00	0.0000E+00	0.0000E+00

SPATIAL COMB 2

SRSS	19	-0.1001E-01	-0.5988E+00	-0.6176E+00	0.0000E+00	0.0000E+00	0.0000E+00
CQC	19	0.4763E-02	-0.6644E+00	-0.6124E+00	0.0000E+00	0.0000E+00	0.0000E+00
GROUPING	19	-0.9841E-02	-0.5872E+00	-0.6175E+00	0.0000E+00	0.0000E+00	0.0000E+00
10 %	19	-0.9841E-02	-0.5869E+00	-0.6175E+00	0.0000E+00	0.0000E+00	0.0000E+00
DOUBLE SUM	19	0.7665E-02	-0.5208E+00	-0.6102E+00	0.0000E+00	0.0000E+00	0.0000E+00

SPATIAL COMB 3

SRSS	19	-0.6040E+00	0.3026E-02	-0.6176E+00	0.0000E+00	0.0000E+00	0.0000E+00
CQC	19	-0.5981E+00	-0.1610E+00	-0.6124E+00	0.0000E+00	0.0000E+00	0.0000E+00
GROUPING	19	-0.6039E+00	0.3197E-01	-0.6175E+00	0.0000E+00	0.0000E+00	0.0000E+00

DOUBLE SUM	19	-0.5969E+00	0.1980E+00	-0.6102E+00	0.0000E+00	0.0000E+00	0.0000E+00
SPATIAL COMB 4							
SRSS	19	-0.6040E+00	-0.5988E+00	-0.4396E-01	0.0000E+00	0.0000E+00	0.0000E+00
CQC	19	-0.5981E+00	-0.6644E+00	-0.3104E-01	0.0000E+00	0.0000E+00	0.0000E+00
GROUPING	19	-0.6039E+00	-0.5872E+00	-0.4374E-01	0.0000E+00	0.0000E+00	0.0000E+00
10 %	19	-0.6039E+00	-0.5869E+00	-0.4374E-01	0.0000E+00	0.0000E+00	0.0000E+00
DOUBLE SUM	19	-0.5969E+00	-0.5208E+00	-0.2544E-01	0.0000E+00	0.0000E+00	0.0000E+00
SPATIAL COMB 1							
SRSS	22	-0.2365E-02	-0.2692E+00	-0.4490E-01	0.0000E+00	0.0000E+00	0.0000E+00
CQC	22	0.5605E-02	-0.1559E+00	-0.3181E-01	0.0000E+00	0.0000E+00	0.0000E+00
GROUPING	22	-0.1654E-02	-0.2587E+00	-0.4465E-01	0.0000E+00	0.0000E+00	0.0000E+00
10 %	22	-0.1654E-02	-0.2572E+00	-0.4465E-01	0.0000E+00	0.0000E+00	0.0000E+00
DOUBLE SUM	22	0.7837E-02	-0.1434E+00	-0.2616E-01	0.0000E+00	0.0000E+00	0.0000E+00
SPATIAL COMB 2							
SRSS	22	-0.2365E-02	-0.7077E+00	-0.6180E+00	0.0000E+00	0.0000E+00	0.0000E+00
CQC	22	0.5605E-02	-0.6624E+00	-0.6127E+00	0.0000E+00	0.0000E+00	0.0000E+00
GROUPING	22	-0.1654E-02	-0.7035E+00	-0.6179E+00	0.0000E+00	0.0000E+00	0.0000E+00
10 %	22	-0.1654E-02	-0.7029E+00	-0.6179E+00	0.0000E+00	0.0000E+00	0.0000E+00
DOUBLE SUM	22	0.7837E-02	-0.6574E+00	-0.6105E+00	0.0000E+00	0.0000E+00	0.0000E+00
SPATIAL COMB 3							
SRSS	22	-0.6010E+00	-0.2692E+00	-0.6180E+00	0.0000E+00	0.0000E+00	0.0000E+00
CQC	22	-0.5978E+00	-0.1559E+00	-0.6127E+00	0.0000E+00	0.0000E+00	0.0000E+00
GROUPING	22	-0.6007E+00	-0.2587E+00	-0.6179E+00	0.0000E+00	0.0000E+00	0.0000E+00
10 %	22	-0.6007E+00	-0.2572E+00	-0.6179E+00	0.0000E+00	0.0000E+00	0.0000E+00
DOUBLE SUM	22	-0.5969E+00	-0.1434E+00	-0.6105E+00	0.0000E+00	0.0000E+00	0.0000E+00
SPATIAL COMB 4							
SRSS	22	-0.6010E+00	-0.7077E+00	-0.4490E-01	0.0000E+00	0.0000E+00	0.0000E+00
CQC	22	-0.5978E+00	-0.6624E+00	-0.3181E-01	0.0000E+00	0.0000E+00	0.0000E+00
GROUPING	22	-0.6007E+00	-0.7035E+00	-0.4465E-01	0.0000E+00	0.0000E+00	0.0000E+00
10 %	22	-0.6007E+00	-0.7029E+00	-0.4465E-01	0.0000E+00	0.0000E+00	0.0000E+00
DOUBLE SUM	22	-0.5969E+00	-0.6574E+00	-0.2616E-01	0.0000E+00	0.0000E+00	0.0000E+00

Errors in forces of building 1
Element 1

SRSS	1	-0.2323E-01	-0.2520E+00	0.1900E+00	0.0000E+00	0.1900E+00	-0.2520E+00
	2	-0.2323E-01	-0.2520E+00	0.1900E+00	0.0000E+00	0.1900E+00	-0.2520E+00
CQC	1	-0.5204E-01	-0.1351E+00	0.1625E+00	0.0000E+00	0.1625E+00	-0.1351E+00
	2	-0.5204E-01	-0.1351E+00	0.1625E+00	0.0000E+00	0.1625E+00	-0.1351E+00
GROUPING	1	-0.2262E-01	-0.2095E+00	0.1913E+00	0.0000E+00	0.1913E+00	-0.2095E+00
	2	-0.2262E-01	-0.2095E+00	0.1913E+00	0.0000E+00	0.1913E+00	-0.2095E+00
10 %	1	-0.2260E-01	-0.2078E+00	0.1913E+00	0.0000E+00	0.1913E+00	-0.2078E+00
	2	-0.2260E-01	-0.2078E+00	0.1913E+00	0.0000E+00	0.1913E+00	-0.2078E+00
DOUBLE SUM	1	0.1852E-01	-0.1270E+00	0.3174E+00	0.0000E+00	0.3174E+00	-0.1270E+00
	2	0.1852E-01	-0.1270E+00	0.3174E+00	0.0000E+00	0.3174E+00	-0.1270E+00

SPATIAL COMB 2

SRSS	1	-0.2323E-01	-0.7008E+00	-0.5240E+00	0.0000E+00	-0.5240E+00	-0.7008E+00
	2	-0.2323E-01	-0.7008E+00	-0.5240E+00	0.0000E+00	-0.5240E+00	-0.7008E+00
CQC	1	-0.5204E-01	-0.6540E+00	-0.5350E+00	0.0000E+00	-0.5350E+00	-0.6540E+00
	2	-0.5204E-01	-0.6540E+00	-0.5350E+00	0.0000E+00	-0.5350E+00	-0.6540E+00
GROUPING	1	-0.2262E-01	-0.6838E+00	-0.5235E+00	0.0000E+00	-0.5235E+00	-0.6838E+00
	2	-0.2262E-01	-0.6838E+00	-0.5235E+00	0.0000E+00	-0.5235E+00	-0.6838E+00
10 %	1	-0.2260E-01	-0.6831E+00	-0.5235E+00	0.0000E+00	-0.5235E+00	-0.6831E+00
	2	-0.2260E-01	-0.6831E+00	-0.5235E+00	0.0000E+00	-0.5235E+00	-0.6831E+00
DOUBLE SUM	1	0.1852E-01	-0.6508E+00	-0.4730E+00	0.0000E+00	-0.4730E+00	-0.6508E+00
	2	0.1852E-01	-0.6508E+00	-0.4730E+00	0.0000E+00	-0.4730E+00	-0.6508E+00

SPATIAL COMB 3

SRSS	1	-0.6093E+00	-0.2520E+00	-0.5240E+00	0.0000E+00	-0.5240E+00	-0.2520E+00
	2	-0.6093E+00	-0.2520E+00	-0.5240E+00	0.0000E+00	-0.5240E+00	-0.2520E+00
CQC	1	-0.6208E+00	-0.1351E+00	-0.5350E+00	0.0000E+00	-0.5350E+00	-0.1351E+00
	2	-0.6208E+00	-0.1351E+00	-0.5350E+00	0.0000E+00	-0.5350E+00	-0.1351E+00
GROUPING	1	-0.6091E+00	-0.2095E+00	-0.5235E+00	0.0000E+00	-0.5235E+00	-0.2095E+00
	2	-0.6091E+00	-0.2095E+00	-0.5235E+00	0.0000E+00	-0.5235E+00	-0.2095E+00
10 %	1	-0.6090E+00	-0.2078E+00	-0.5235E+00	0.0000E+00	-0.5235E+00	-0.2078E+00
	2	-0.6090E+00	-0.2078E+00	-0.5235E+00	0.0000E+00	-0.5235E+00	-0.2078E+00
DOUBLE SUM	1	-0.5926E+00	-0.1270E+00	-0.4730E+00	0.0000E+00	-0.4730E+00	-0.1270E+00
	2	-0.5926E+00	-0.1270E+00	-0.4730E+00	0.0000E+00	-0.4730E+00	-0.1270E+00

SPATIAL COMB 4

SRSS	1	-0.6093E+00	-0.7008E+00	0.1900E+00	0.0000E+00	0.1900E+00	-0.7008E+00
	2	-0.6093E+00	-0.7008E+00	0.1900E+00	0.0000E+00	0.1900E+00	-0.7008E+00
CQC	1	-0.6208E+00	-0.6540E+00	0.1625E+00	0.0000E+00	0.1625E+00	-0.6540E+00
	2	-0.6208E+00	-0.6540E+00	0.1625E+00	0.0000E+00	0.1625E+00	-0.6540E+00
GROUPING	1	-0.6091E+00	-0.6838E+00	0.1913E+00	0.0000E+00	0.1913E+00	-0.6838E+00

	2	-0.6091E+00	-0.6838E+00	0.1913E+00	0.0000E+00	0.1913E+00	-0.6838E+00
10 %	1	-0.6090E+00	-0.6831E+00	0.1913E+00	0.0000E+00	0.1913E+00	-0.6831E+00
	2	-0.6090E+00	-0.6831E+00	0.1913E+00	0.0000E+00	0.1913E+00	-0.6831E+00
DOUBLE SUM	1	-0.5926E+00	-0.6508E+00	0.3174E+00	0.0000E+00	0.3174E+00	-0.6508E+00
	2	-0.5926E+00	-0.6508E+00	0.3174E+00	0.0000E+00	0.3174E+00	-0.6508E+00

Element 9
SPATIAL COMB 1

SRSS	5	-0.1278E+00	-0.2467E+00	0.2079E+00	0.0000E+00	0.2080E+00	-0.2467E+00
	6	-0.1278E+00	-0.2467E+00	0.2079E+00	0.0000E+00	0.2080E+00	-0.2467E+00
CQC	5	-0.1135E+00	-0.1306E+00	0.1839E+00	0.0000E+00	0.1839E+00	-0.1306E+00
	6	-0.1135E+00	-0.1306E+00	0.1839E+00	0.0000E+00	0.1839E+00	-0.1306E+00
GROUPING	5	-0.1032E+00	-0.2051E+00	0.2086E+00	0.0000E+00	0.2086E+00	-0.2052E+00
	6	-0.1032E+00	-0.2051E+00	0.2086E+00	0.0000E+00	0.2086E+00	-0.2052E+00
10 %	5	-0.1028E+00	-0.2036E+00	0.2086E+00	0.0000E+00	0.2086E+00	-0.2036E+00
	6	-0.1028E+00	-0.2036E+00	0.2086E+00	0.0000E+00	0.2086E+00	-0.2036E+00
DOUBLE SUM	5	-0.3144E-01	-0.1226E+00	0.3323E+00	0.0000E+00	0.3323E+00	-0.1226E+00
	6	-0.3144E-01	-0.1226E+00	0.3323E+00	0.0000E+00	0.3323E+00	-0.1226E+00

SPATIAL COMB 2

SRSS	5	-0.1278E+00	-0.6987E+00	-0.5168E+00	0.0000E+00	-0.5168E+00	-0.6987E+00
	6	-0.1278E+00	-0.6987E+00	-0.5168E+00	0.0000E+00	-0.5168E+00	-0.6987E+00
CQC	5	-0.1135E+00	-0.6522E+00	-0.5264E+00	0.0000E+00	-0.5264E+00	-0.6522E+00
	6	-0.1135E+00	-0.6522E+00	-0.5264E+00	0.0000E+00	-0.5264E+00	-0.6522E+00
GROUPING	5	-0.1032E+00	-0.6821E+00	-0.5165E+00	0.0000E+00	-0.5165E+00	-0.6821E+00
	6	-0.1032E+00	-0.6821E+00	-0.5165E+00	0.0000E+00	-0.5165E+00	-0.6821E+00
10 %	5	-0.1028E+00	-0.6815E+00	-0.5165E+00	0.0000E+00	-0.5165E+00	-0.6815E+00
	6	-0.1028E+00	-0.6815E+00	-0.5165E+00	0.0000E+00	-0.5165E+00	-0.6815E+00
DOUBLE SUM	5	-0.3144E-01	-0.6491E+00	-0.4671E+00	0.0000E+00	-0.4671E+00	-0.6491E+00
	6	-0.3144E-01	-0.6491E+00	-0.4671E+00	0.0000E+00	-0.4671E+00	-0.6491E+00

SPATIAL COMB 3

SRSS	5	-0.6511E+00	-0.2467E+00	-0.5168E+00	0.0000E+00	-0.5168E+00	-0.2467E+00
	6	-0.6511E+00	-0.2467E+00	-0.5168E+00	0.0000E+00	-0.5168E+00	-0.2467E+00
CQC	5	-0.6454E+00	-0.1306E+00	-0.5264E+00	0.0000E+00	-0.5264E+00	-0.1306E+00
	6	-0.6454E+00	-0.1306E+00	-0.5264E+00	0.0000E+00	-0.5264E+00	-0.1306E+00
GROUPING	5	-0.6413E+00	-0.2051E+00	-0.5165E+00	0.0000E+00	-0.5165E+00	-0.2052E+00
	6	-0.6413E+00	-0.2051E+00	-0.5165E+00	0.0000E+00	-0.5165E+00	-0.2052E+00
10 %	5	-0.6411E+00	-0.2036E+00	-0.5165E+00	0.0000E+00	-0.5165E+00	-0.2036E+00
	6	-0.6411E+00	-0.2036E+00	-0.5165E+00	0.0000E+00	-0.5165E+00	-0.2036E+00
DOUBLE SUM	5	-0.6126E+00	-0.1226E+00	-0.4671E+00	0.0000E+00	-0.4671E+00	-0.1226E+00
	6	-0.6126E+00	-0.1226E+00	-0.4671E+00	0.0000E+00	-0.4671E+00	-0.1226E+00

SPATIAL COMB 4

SRSS	5	-0.6511E+00	-0.6987E+00	0.2079E+00	0.0000E+00	0.2080E+00	-0.6987E+00
	6	-0.6511E+00	-0.6987E+00	0.2079E+00	0.0000E+00	0.2080E+00	-0.6987E+00
CQC	5	-0.6454E+00	-0.6522E+00	0.1839E+00	0.0000E+00	0.1839E+00	-0.6522E+00
	6	-0.6454E+00	-0.6522E+00	0.1839E+00	0.0000E+00	0.1839E+00	-0.6522E+00
GROUPING	5	-0.6413E+00	-0.6821E+00	0.2086E+00	0.0000E+00	0.2086E+00	-0.6821E+00
	6	-0.6413E+00	-0.6821E+00	0.2086E+00	0.0000E+00	0.2086E+00	-0.6821E+00
10 %	5	-0.6411E+00	-0.6815E+00	0.2086E+00	0.0000E+00	0.2086E+00	-0.6815E+00
	6	-0.6411E+00	-0.6815E+00	0.2086E+00	0.0000E+00	0.2086E+00	-0.6815E+00
DOUBLE SUM	5	-0.6126E+00	-0.6491E+00	0.3323E+00	0.0000E+00	0.3323E+00	-0.6491E+00
	6	-0.6126E+00	-0.6491E+00	0.3323E+00	0.0000E+00	0.3323E+00	-0.6491E+00

Element 39
SPATIAL COMB 1

SRSS	19	-0.1126E-01	-0.2378E+00	-0.2426E-01	-0.2378E+00	-0.1126E-01	0.0000E+00
	22	-0.1126E-01	-0.2378E+00	-0.2426E-01	-0.2378E+00	-0.1126E-01	0.0000E+00
CQC	19	0.6936E-02	-0.1705E+00	-0.1435E-01	-0.1705E+00	0.6934E-02	0.0000E+00
	22	0.6936E-02	-0.1705E+00	-0.1435E-01	-0.1705E+00	0.6934E-02	0.0000E+00
GROUPING	19	-0.1124E-01	-0.2081E+00	-0.2425E-01	-0.2081E+00	-0.1124E-01	0.0000E+00
	22	-0.1124E-01	-0.2081E+00	-0.2425E-01	-0.2081E+00	-0.1124E-01	0.0000E+00
10 %	19	-0.1124E-01	-0.2064E+00	-0.2425E-01	-0.2064E+00	-0.1124E-01	0.0000E+00
	22	-0.1124E-01	-0.2064E+00	-0.2425E-01	-0.2064E+00	-0.1124E-01	0.0000E+00
DOUBLE SUM	19	0.1105E-01	-0.1099E+00	-0.9584E-02	-0.1099E+00	0.1105E-01	0.0000E+00
	22	0.1105E-01	-0.1099E+00	-0.9584E-02	-0.1099E+00	0.1105E-01	0.0000E+00

SPATIAL COMB 2

SRSS	19	-0.1126E-01	-0.6951E+00	-0.6097E+00	-0.6951E+00	-0.1126E-01	0.0000E+00
	22	-0.1126E-01	-0.6951E+00	-0.6097E+00	-0.6951E+00	-0.1126E-01	0.0000E+00
CQC	19	0.6936E-02	-0.6682E+00	-0.6057E+00	-0.6682E+00	0.6934E-02	0.0000E+00
	22	0.6936E-02	-0.6682E+00	-0.6057E+00	-0.6682E+00	0.6934E-02	0.0000E+00
GROUPING	19	-0.1124E-01	-0.6832E+00	-0.6097E+00	-0.6832E+00	-0.1124E-01	0.0000E+00
	22	-0.1124E-01	-0.6832E+00	-0.6097E+00	-0.6832E+00	-0.1124E-01	0.0000E+00
10 %	19	-0.1124E-01	-0.6826E+00	-0.6097E+00	-0.6826E+00	-0.1124E-01	0.0000E+00
	22	-0.1124E-01	-0.6826E+00	-0.6097E+00	-0.6826E+00	-0.1124E-01	0.0000E+00
DOUBLE SUM	19	0.1105E-01	-0.6440E+00	-0.6038E+00	-0.6440E+00	0.1105E-01	0.0000E+00
	22	0.1105E-01	-0.6440E+00	-0.6038E+00	-0.6440E+00	0.1105E-01	0.0000E+00

SPATIAL COMB 3

SRSS	19	-0.6045E+00	-0.2378E+00	-0.6097E+00	-0.2378E+00	-0.6045E+00	0.0000E+00
	22	-0.6045E+00	-0.2378E+00	-0.6097E+00	-0.2378E+00	-0.6045E+00	0.0000E+00
CQC	19	-0.5972E+00	-0.1705E+00	-0.6057E+00	-0.1705E+00	-0.5972E+00	0.0000E+00
	22	-0.5972E+00	-0.1705E+00	-0.6057E+00	-0.1705E+00	-0.5972E+00	0.0000E+00

GROUPING	19	-0.6045E+00	-0.2081E+00	-0.6097E+00	-0.2081E+00	-0.6045E+00	0.0000E+00
	22	-0.6045E+00	-0.2081E+00	-0.6097E+00	-0.2081E+00	-0.6045E+00	0.0000E+00
10 %	19	-0.6045E+00	-0.2064E+00	-0.6097E+00	-0.2064E+00	-0.6045E+00	0.0000E+00
	22	-0.6045E+00	-0.2064E+00	-0.6097E+00	-0.2064E+00	-0.6045E+00	0.0000E+00
DOUBLE SUM	19	-0.5956E+00	-0.1099E+00	-0.6038E+00	-0.1099E+00	-0.5956E+00	0.0000E+00
	22	-0.5956E+00	-0.1099E+00	-0.6038E+00	-0.1099E+00	-0.5956E+00	0.0000E+00

SPATIAL COMB 4

SRSS	19	-0.6045E+00	-0.6951E+00	-0.2426E-01	-0.6951E+00	-0.6045E+00	0.0000E+00
	22	-0.6045E+00	-0.6951E+00	-0.2426E-01	-0.6951E+00	-0.6045E+00	0.0000E+00
CQC	19	-0.5972E+00	-0.6682E+00	-0.1435E-01	-0.6682E+00	-0.5972E+00	0.0000E+00
	22	-0.5972E+00	-0.6682E+00	-0.1435E-01	-0.6682E+00	-0.5972E+00	0.0000E+00
GROUPING	19	-0.6045E+00	-0.6832E+00	-0.2425E-01	-0.6832E+00	-0.6045E+00	0.0000E+00
	22	-0.6045E+00	-0.6832E+00	-0.2425E-01	-0.6832E+00	-0.6045E+00	0.0000E+00
10 %	19	-0.6045E+00	-0.6826E+00	-0.2425E-01	-0.6826E+00	-0.6045E+00	0.0000E+00
	22	-0.6045E+00	-0.6826E+00	-0.2425E-01	-0.6826E+00	-0.6045E+00	0.0000E+00
DOUBLE SUM	19	-0.5956E+00	-0.6440E+00	-0.9584E-02	-0.6440E+00	-0.5956E+00	0.0000E+00
	22	-0.5956E+00	-0.6440E+00	-0.9584E-02	-0.6440E+00	-0.5956E+00	0.0000E+00

Element 47

SPATIAL COMB 1

SRSS	30	-0.2366E-02	-0.2692E+00	-0.4490E-01	-0.4490E-01	0.0000E+00	-0.2366E-02
	22	-0.2366E-02	-0.2692E+00	-0.4490E-01	-0.4490E-01	0.0000E+00	-0.2366E-02
CQC	30	0.5605E-02	-0.1559E+00	-0.3181E-01	-0.3181E-01	0.0000E+00	0.5605E-02
	22	0.5605E-02	-0.1559E+00	-0.3181E-01	-0.3181E-01	0.0000E+00	0.5605E-02
GROUPING	30	-0.1651E-02	-0.2587E+00	-0.4465E-01	-0.4465E-01	0.0000E+00	-0.1655E-02
	22	-0.1651E-02	-0.2587E+00	-0.4465E-01	-0.4465E-01	0.0000E+00	-0.1655E-02
10 %	30	-0.1651E-02	-0.2572E+00	-0.4465E-01	-0.4465E-01	0.0000E+00	-0.1655E-02
	22	-0.1651E-02	-0.2572E+00	-0.4465E-01	-0.4465E-01	0.0000E+00	-0.1655E-02
DOUBLE SUM	30	0.7835E-02	-0.1434E+00	-0.2615E-01	-0.2615E-01	0.0000E+00	0.7835E-02
	22	0.7835E-02	-0.1434E+00	-0.2615E-01	-0.2615E-01	0.0000E+00	0.7835E-02

SPATIAL COMB 2

SRSS	30	-0.2366E-02	-0.7077E+00	-0.6180E+00	-0.6180E+00	0.0000E+00	-0.2366E-02
	22	-0.2366E-02	-0.7077E+00	-0.6180E+00	-0.6180E+00	0.0000E+00	-0.2366E-02
CQC	30	0.5605E-02	-0.6624E+00	-0.6127E+00	-0.6127E+00	0.0000E+00	0.5605E-02
	22	0.5605E-02	-0.6624E+00	-0.6127E+00	-0.6127E+00	0.0000E+00	0.5605E-02
GROUPING	30	-0.1651E-02	-0.7035E+00	-0.6179E+00	-0.6179E+00	0.0000E+00	-0.1655E-02
	22	-0.1651E-02	-0.7035E+00	-0.6179E+00	-0.6179E+00	0.0000E+00	-0.1655E-02
10 %	30	-0.1651E-02	-0.7029E+00	-0.6179E+00	-0.6179E+00	0.0000E+00	-0.1655E-02
	22	-0.1651E-02	-0.7029E+00	-0.6179E+00	-0.6179E+00	0.0000E+00	-0.1655E-02
DOUBLE SUM	30	0.7835E-02	-0.6574E+00	-0.6105E+00	-0.6105E+00	0.0000E+00	0.7835E-02
	22	0.7835E-02	-0.6574E+00	-0.6105E+00	-0.6105E+00	0.0000E+00	0.7835E-02

SPATIAL COMB 3

SRSS	30	-0.6010E+00	-0.2692E+00	-0.6180E+00	-0.6180E+00	0.0000E+00	-0.6010E+00
	22	-0.6010E+00	-0.2692E+00	-0.6180E+00	-0.6180E+00	0.0000E+00	-0.6010E+00
CQC	30	-0.5978E+00	-0.1559E+00	-0.6127E+00	-0.6127E+00	0.0000E+00	-0.5978E+00
	22	-0.5978E+00	-0.1559E+00	-0.6127E+00	-0.6127E+00	0.0000E+00	-0.5978E+00
GROUPING	30	-0.6007E+00	-0.2587E+00	-0.6179E+00	-0.6179E+00	0.0000E+00	-0.6007E+00
	22	-0.6007E+00	-0.2587E+00	-0.6179E+00	-0.6179E+00	0.0000E+00	-0.6007E+00
10 %	30	-0.6007E+00	-0.2572E+00	-0.6179E+00	-0.6179E+00	0.0000E+00	-0.6007E+00
	22	-0.6007E+00	-0.2572E+00	-0.6179E+00	-0.6179E+00	0.0000E+00	-0.6007E+00
DOUBLE SUM	30	-0.5969E+00	-0.1434E+00	-0.6105E+00	-0.6105E+00	0.0000E+00	-0.5969E+00
	22	-0.5969E+00	-0.1434E+00	-0.6105E+00	-0.6105E+00	0.0000E+00	-0.5969E+00

SPATIAL COMB 4

SRSS	30	-0.6010E+00	-0.7077E+00	-0.4490E-01	-0.4490E-01	0.0000E+00	-0.6010E+00
	22	-0.6010E+00	-0.7077E+00	-0.4490E-01	-0.4490E-01	0.0000E+00	-0.6010E+00
CQC	30	-0.5978E+00	-0.6624E+00	-0.3181E-01	-0.3181E-01	0.0000E+00	-0.5978E+00
	22	-0.5978E+00	-0.6624E+00	-0.3181E-01	-0.3181E-01	0.0000E+00	-0.5978E+00
GROUPING	30	-0.6007E+00	-0.7035E+00	-0.4465E-01	-0.4465E-01	0.0000E+00	-0.6007E+00
	22	-0.6007E+00	-0.7035E+00	-0.4465E-01	-0.4465E-01	0.0000E+00	-0.6007E+00
10 %	30	-0.6007E+00	-0.7029E+00	-0.4465E-01	-0.4465E-01	0.0000E+00	-0.6007E+00
	22	-0.6007E+00	-0.7029E+00	-0.4465E-01	-0.4465E-01	0.0000E+00	-0.6007E+00
DOUBLE SUM	30	-0.5969E+00	-0.6574E+00	-0.2615E-01	-0.2615E-01	0.0000E+00	-0.5969E+00
	22	-0.5969E+00	-0.6574E+00	-0.2615E-01	-0.2615E-01	0.0000E+00	-0.5969E+00

TABLE 9
Properties of modes of building 2

```
---------------------------------------------------------------------------------------
mode    1    1 fr=  0.40889E+01 dp=  0.0500 px=  0.31664E-01  py=  0.37616E-04  pz=  0.15131E+01
mx=  0.31271E-03  my=  0.44134E-09  mz=  0.71407E+00 cmx=  0.31271E-03 cmy=  0.44134E-09 cmz=  0.71407E+00
mode    2    2 fr=  0.47421E+01 dp=  0.0500 px=  0.14709E+01  py=  0.17475E-02  pz=  0.89257E-04
mx=  0.70480E+00  my=  0.99480E-06  mz=  0.25953E-08 cmx=  0.70511E+00 cmy=  0.99524E-06 cmz=  0.71407E+00
mode    3    3 fr=  0.47564E+01 dp=  0.0500 px=  0.84276E-04  py=  0.98220E-07  pz= -0.44553E+00
mx=  0.80635E-09  my=  0.10953E-14  mz=  0.22536E-01 cmx=  0.70511E+00 cmy=  0.99524E-06 cmz=  0.73661E+00
mode    4    4 fr=  0.65868E+01 dp=  0.0500 px= -0.13313E-04  py= -0.15825E-07  pz= -0.24898E-01
mx=  0.84496E-10  my=  0.11939E-15  mz=  0.29555E-03 cmx=  0.70511E+00 cmy=  0.99524E-06 cmz=  0.73690E+00
mode    5    5 fr=  0.10954E+02 dp=  0.0500 px=  0.37264E-05  py=  0.74081E-08  pz=  0.49016E-01
mx=  0.82034E-11  my=  0.32422E-16  mz=  0.14194E-02 cmx=  0.70511E+00 cmy=  0.99524E-06 cmz=  0.73832E+00
mode    6    6 fr=  0.15833E+02 dp=  0.0500 px=  0.10757E-04  py= -0.36101E-07  pz=  0.54723E+00
mx=  0.11693E-10  my=  0.13170E-15  mz=  0.30261E-01 cmx=  0.70511E+00 cmy=  0.99524E-06 cmz=  0.76858E+00
mode    7    7 fr=  0.16419E+02 dp=  0.0500 px= -0.61946E+00  py=  0.20496E-02  pz=  0.81245E-02
mx=  0.20350E+00  my=  0.22278E-05  mz=  0.35004E-04 cmx=  0.90861E+00 cmy=  0.32230E-05 cmz=  0.76862E+00
mode    8    8 fr=  0.16463E+02 dp=  0.0500 px=  0.51783E-03  py= -0.17205E-05  pz=  0.69440E+00
mx=  0.75452E-07  my=  0.83295E-12  mz=  0.13568E+00 cmx=  0.90861E+00 cmy=  0.32230E-05 cmz=  0.90430E+00
mode    9    9 fr=  0.18802E+02 dp=  0.0500 px= -0.20701E-05  py=  0.57659E-08  pz=  0.55031E-01
mx=  0.19918E-11  my=  0.15453E-16  mz=  0.14076E-02 cmx=  0.90861E+00 cmy=  0.32230E-05 cmz=  0.90571E+00
mode   10   10 fr=  0.20602E+02 dp=  0.0500 px=  0.10516E-06  py=  0.25125E-08  pz=  0.31636E+00
mx=  0.22698E-14  my=  0.12955E-17  mz=  0.20541E-01 cmx=  0.90861E+00 cmy=  0.32230E-05 cmz=  0.92625E+00
mode   11   11 fr=  0.39749E+02 dp=  0.0500 px= -0.57649E+00  py= -0.24477E-02  pz=  0.71118E-03
mx=  0.79903E-01  my=  0.14404E-05  mz=  0.12160E-06 cmx=  0.98851E+00 cmy=  0.46634E-05 cmz=  0.92625E+00

no. of modes considered = 10
```

TABLE 10

Response of building 2 by R.S.T

****

NODAL DISP. IN GLOBAL BY R.S.T

****

NODE = 1

spatial combination A (srss)

method	node	Ux	Uy	Uz	Rxx	Ryy	Rzz
SRSS	1	0.113790E-01	0.432787E-07	0.162554E-01	0.000000E+00	0.000000E+00	0.000000E+00
CQC	1	0.113786E-01	0.436414E-07	0.161287E-01	0.000000E+00	0.000000E+00	0.000000E+00
GROUPING	1	0.113791E-01	0.432798E-07	0.162554E-01	0.000000E+00	0.000000E+00	0.000000E+00
10 %	1	0.113791E-01	0.432798E-07	0.162554E-01	0.000000E+00	0.000000E+00	0.000000E+00
DOUBLE SUM	1	0.113817E-01	0.437051E-07	0.163976E-01	0.000000E+00	0.000000E+00	0.000000E+00

spatial combination B (R=R1+0.4R2+0.4R3)

SRSS	1	0.113790E-01	0.173115E-07	0.650215E-02	0.000000E+00	0.000000E+00	0.000000E+00
CQC	1	0.113786E-01	0.174566E-07	0.645149E-02	0.000000E+00	0.000000E+00	0.000000E+00
GROUPING	1	0.113791E-01	0.173119E-07	0.650217E-02	0.000000E+00	0.000000E+00	0.000000E+00
10 %	1	0.113791E-01	0.173119E-07	0.650217E-02	0.000000E+00	0.000000E+00	0.000000E+00
DOUBLE SUM	1	0.113817E-01	0.174821E-07	0.655903E-02	0.000000E+00	0.000000E+00	0.000000E+00

spatial combination C (R=0.4R1+R2+0.4R3)

SRSS	1	0.455161E-02	0.432787E-07	0.650215E-02	0.000000E+00	0.000000E+00	0.000000E+00
CQC	1	0.455144E-02	0.436414E-07	0.645149E-02	0.000000E+00	0.000000E+00	0.000000E+00
GROUPING	1	0.455163E-02	0.432798E-07	0.650217E-02	0.000000E+00	0.000000E+00	0.000000E+00
10 %	1	0.455163E-02	0.432798E-07	0.650217E-02	0.000000E+00	0.000000E+00	0.000000E+00
DOUBLE SUM	1	0.455269E-02	0.437051E-07	0.655903E-02	0.000000E+00	0.000000E+00	0.000000E+00

spatial combination D (R=0.4R1+0.4R2+R3)

SRSS	1	0.455161E-02	0.173115E-07	0.162554E-01	0.000000E+00	0.000000E+00	0.000000E+00
CQC	1	0.455144E-02	0.174566E-07	0.161287E-01	0.000000E+00	0.000000E+00	0.000000E+00
GROUPING	1	0.455163E-02	0.173119E-07	0.162554E-01	0.000000E+00	0.000000E+00	0.000000E+00
10 %	1	0.455163E-02	0.173119E-07	0.162554E-01	0.000000E+00	0.000000E+00	0.000000E+00
DOUBLE SUM	1	0.455269E-02	0.174821E-07	0.163976E-01	0.000000E+00	0.000000E+00	0.000000E+00

NODE = 5

spatial combination A (srss)

method	node	Ux	Uy	Uz	Rxx	Ryy	Rzz
SRSS	5	0.825261E-02	0.389733E-07	0.115187E-01	0.000000E+00	0.000000E+00	0.000000E+00
CQC	5	0.825320E-02	0.392992E-07	0.114438E-01	0.000000E+00	0.000000E+00	0.000000E+00
GROUPING	5	0.825264E-02	0.389742E-07	0.115187E-01	0.000000E+00	0.000000E+00	0.000000E+00
10 %	5	0.825264E-02	0.389742E-07	0.115187E-01	0.000000E+00	0.000000E+00	0.000000E+00
DOUBLE SUM	5	0.825342E-02	0.393552E-07	0.116032E-01	0.000000E+00	0.000000E+00	0.000000E+00

spatial combination B (R=R1+0.4R2+0.4R3)

SRSS	5	0.825261E-02	0.155893E-07	0.460748E-02	0.000000E+00	0.000000E+00	0.000000E+00
CQC	5	0.825320E-02	0.157197E-07	0.457750E-02	0.000000E+00	0.000000E+00	0.000000E+00
GROUPING	5	0.825264E-02	0.155897E-07	0.460749E-02	0.000000E+00	0.000000E+00	0.000000E+00
10 %	5	0.825264E-02	0.155897E-07	0.460749E-02	0.000000E+00	0.000000E+00	0.000000E+00
DOUBLE SUM	5	0.825342E-02	0.157421E-07	0.464128E-02	0.000000E+00	0.000000E+00	0.000000E+00

spatial combination C (R=0.4R1+R2+0.4R3)

SRSS	5	0.330104E-02	0.389733E-07	0.460748E-02	0.000000E+00	0.000000E+00	0.000000E+00
CQC	5	0.330128E-02	0.392992E-07	0.457750E-02	0.000000E+00	0.000000E+00	0.000000E+00
GROUPING	5	0.330106E-02	0.389742E-07	0.460749E-02	0.000000E+00	0.000000E+00	0.000000E+00
10 %	5	0.330106E-02	0.389742E-07	0.460749E-02	0.000000E+00	0.000000E+00	0.000000E+00
DOUBLE SUM	5	0.330137E-02	0.393552E-07	0.464128E-02	0.000000E+00	0.000000E+00	0.000000E+00

spatial combination D (R=0.4R1+0.4R2+R3)

SRSS	5	0.330104E-02	0.155893E-07	0.115187E-01	0.000000E+00	0.000000E+00	0.000000E+00
CQC	5	0.330128E-02	0.157197E-07	0.114438E-01	0.000000E+00	0.000000E+00	0.000000E+00
GROUPING	5	0.330106E-02	0.155897E-07	0.115187E-01	0.000000E+00	0.000000E+00	0.000000E+00
10 %	5	0.330106E-02	0.155897E-07	0.115187E-01	0.000000E+00	0.000000E+00	0.000000E+00
DOUBLE SUM	5	0.330137E-02	0.157421E-07	0.116032E-01	0.000000E+00	0.000000E+00	0.000000E+00

NODE = 16

spatial combination A (srss)

method	node	Ux	Uy	Uz	Rxx	Ryy	Rzz

SRSS	16	0.157943E-02	0.163502E-07	0.207321E-02	0.000000E+00	0.000000E+00	0.000000E+00
CQC	16	0.158001E-02	0.164870E-07	0.206799E-02	0.000000E+00	0.000000E+00	0.000000E+00
GROUPING	16	0.157944E-02	0.163504E-07	0.207345E-02	0.000000E+00	0.000000E+00	0.000000E+00
10 %	16	0.157944E-02	0.163504E-07	0.207345E-02	0.000000E+00	0.000000E+00	0.000000E+00
DOUBLE SUM	16	0.158048E-02	0.165079E-07	0.208129E-02	0.000000E+00	0.000000E+00	0.000000E+00

spatial combination B (R=R1+0.4R2+0.4R3)

SRSS	16	0.157943E-02	0.654007E-08	0.829286E-03	0.000000E+00	0.000000E+00	0.000000E+00
CQC	16	0.158001E-02	0.659481E-08	0.827198E-03	0.000000E+00	0.000000E+00	0.000000E+00
GROUPING	16	0.157944E-02	0.654017E-08	0.829379E-03	0.000000E+00	0.000000E+00	0.000000E+00
10 %	16	0.157944E-02	0.654017E-08	0.829379E-03	0.000000E+00	0.000000E+00	0.000000E+00
DOUBLE SUM	16	0.158048E-02	0.660317E-08	0.832517E-03	0.000000E+00	0.000000E+00	0.000000E+00

spatial combination C (R=0.4R1+R2+0.4R3)

SRSS	16	0.631771E-03	0.163502E-07	0.829286E-03	0.000000E+00	0.000000E+00	0.000000E+00
CQC	16	0.632003E-03	0.164870E-07	0.827198E-03	0.000000E+00	0.000000E+00	0.000000E+00
GROUPING	16	0.631774E-03	0.163504E-07	0.829379E-03	0.000000E+00	0.000000E+00	0.000000E+00
10 %	16	0.631774E-03	0.163504E-07	0.829379E-03	0.000000E+00	0.000000E+00	0.000000E+00
DOUBLE SUM	16	0.632191E-03	0.165079E-07	0.832517E-03	0.000000E+00	0.000000E+00	0.000000E+00

spatial combination D (R=0.4R1+0.4R2+R3)

SRSS	16	0.631771E-03	0.654007E-08	0.207321E-02	0.000000E+00	0.000000E+00	0.000000E+00
CQC	16	0.632003E-03	0.659481E-08	0.206799E-02	0.000000E+00	0.000000E+00	0.000000E+00
GROUPING	16	0.631774E-03	0.654017E-08	0.207345E-02	0.000000E+00	0.000000E+00	0.000000E+00
10 %	16	0.631774E-03	0.654017E-08	0.207345E-02	0.000000E+00	0.000000E+00	0.000000E+00
DOUBLE SUM	16	0.632191E-03	0.660317E-08	0.208129E-02	0.000000E+00	0.000000E+00	0.000000E+00

NODE = 19
spatial combination A (srss)

method	node	Ux	Uy	Uz	Rxx	Ryy	Rzz
SRSS	19	0.157964E-02	0.163588E-07	0.207321E-02	0.000000E+00	0.000000E+00	0.000000E+00
CQC	19	0.158079E-02	0.162448E-07	0.206799E-02	0.000000E+00	0.000000E+00	0.000000E+00
GROUPING	19	0.157965E-02	0.163591E-07	0.207345E-02	0.000000E+00	0.000000E+00	0.000000E+00

10 %	19	0.157965E-02	0.163591E-07	0.207345E-02	0.000000E+00	0.000000E+00	0.000000E+00
DOUBLE SUM	19	0.158134E-02	0.165102E-07	0.208129E-02	0.000000E+00	0.000000E+00	0.000000E+00

spatial combination B (R=R1+0.4R2+0.4R3)

SRSS	19	0.157964E-02	0.654352E-08	0.829286E-03	0.000000E+00	0.000000E+00	0.000000E+00
CQC	19	0.158079E-02	0.649792E-08	0.827198E-03	0.000000E+00	0.000000E+00	0.000000E+00
GROUPING	19	0.157965E-02	0.654363E-08	0.829379E-03	0.000000E+00	0.000000E+00	0.000000E+00
10 %	19	0.157965E-02	0.654363E-08	0.829379E-03	0.000000E+00	0.000000E+00	0.000000E+00
DOUBLE SUM	19	0.158134E-02	0.660408E-08	0.832517E-03	0.000000E+00	0.000000E+00	0.000000E+00

spatial combination C (R=0.4R1+R2+0.4R3)

SRSS	19	0.631856E-03	0.163588E-07	0.829286E-03	0.000000E+00	0.000000E+00	0.000000E+00
CQC	19	0.632318E-03	0.162448E-07	0.827198E-03	0.000000E+00	0.000000E+00	0.000000E+00
GROUPING	19	0.631859E-03	0.163591E-07	0.829379E-03	0.000000E+00	0.000000E+00	0.000000E+00
10 %	19	0.631859E-03	0.163591E-07	0.829379E-03	0.000000E+00	0.000000E+00	0.000000E+00
DOUBLE SUM	19	0.632536E-03	0.165102E-07	0.832517E-03	0.000000E+00	0.000000E+00	0.000000E+00

spatial combination D (R=0.4R1+0.4R2+R3)

SRSS	19	0.631856E-03	0.654352E-08	0.207321E-02	0.000000E+00	0.000000E+00	0.000000E+00
CQC	19	0.632318E-03	0.649792E-08	0.206799E-02	0.000000E+00	0.000000E+00	0.000000E+00
GROUPING	19	0.631859E-03	0.654363E-08	0.207345E-02	0.000000E+00	0.000000E+00	0.000000E+00
10 %	19	0.631859E-03	0.654363E-08	0.207345E-02	0.000000E+00	0.000000E+00	0.000000E+00
DOUBLE SUM	19	0.632536E-03	0.660408E-08	0.208129E-02	0.000000E+00	0.000000E+00	0.000000E+00

NODE = 20
spatial combination A (srss)

method	node	Ux	Uy	Uz	Rxx	Ryy	Rzz
SRSS	20	0.160146E-02	0.657718E-08	0.374098E-02	0.000000E+00	0.000000E+00	0.000000E+00
CQC	20	0.160265E-02	0.649116E-08	0.412527E-02	0.000000E+00	0.000000E+00	0.000000E+00
GROUPING	20	0.160147E-02	0.657814E-08	0.374214E-02	0.000000E+00	0.000000E+00	0.000000E+00
10 %	20	0.160147E-02	0.657814E-08	0.374214E-02	0.000000E+00	0.000000E+00	0.000000E+00
DOUBLE SUM	20	0.160322E-02	0.667501E-08	0.416799E-02	0.000000E+00	0.000000E+00	0.000000E+00

spatial combination B (R=R1+0.4R2+0.4R3)

SRSS	20	0.160146E-02	0.263087E-08	0.149639E-02	0.000000E+00	0.000000E+00	0.000000E+00
CQC	20	0.160265E-02	0.259647E-08	0.165011E-02	0.000000E+00	0.000000E+00	0.000000E+00
GROUPING	20	0.160147E-02	0.263126E-08	0.149686E-02	0.000000E+00	0.000000E+00	0.000000E+00
10 %	20	0.160147E-02	0.263126E-08	0.149686E-02	0.000000E+00	0.000000E+00	0.000000E+00
DOUBLE SUM	20	0.160322E-02	0.267000E-08	0.166720E-02	0.000000E+00	0.000000E+00	0.000000E+00

spatial combination C (R=0.4R1+R2+0.4R3)

SRSS	20	0.640583E-03	0.657718E-08	0.149639E-02	0.000000E+00	0.000000E+00	0.000000E+00
CQC	20	0.641059E-03	0.649116E-08	0.165011E-02	0.000000E+00	0.000000E+00	0.000000E+00
GROUPING	20	0.640586E-03	0.657814E-08	0.149686E-02	0.000000E+00	0.000000E+00	0.000000E+00
10 %	20	0.640586E-03	0.657814E-08	0.149686E-02	0.000000E+00	0.000000E+00	0.000000E+00
DOUBLE SUM	20	0.641286E-03	0.667501E-08	0.166720E-02	0.000000E+00	0.000000E+00	0.000000E+00

spatial combination D (R=0.4R1+0.4R2+R3)

SRSS	20	0.640583E-03	0.263087E-08	0.374098E-02	0.000000E+00	0.000000E+00	0.000000E+00
CQC	20	0.641059E-03	0.259647E-08	0.412527E-02	0.000000E+00	0.000000E+00	0.000000E+00
GROUPING	20	0.640586E-03	0.263126E-08	0.374214E-02	0.000000E+00	0.000000E+00	0.000000E+00
10 %	20	0.640586E-03	0.263126E-08	0.374214E-02	0.000000E+00	0.000000E+00	0.000000E+00
DOUBLE SUM	20	0.641286E-03	0.267000E-08	0.416799E-02	0.000000E+00	0.000000E+00	0.000000E+00

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ELEMENT FORCES IN GLOBAL BY R.S.T

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ELEMENT = 1

spatial combination A (srss)

method	node	Fx	Fy	Fz	Mxx	Myy	Mzz
SRSS	1	0.305326E+03	0.967219E+00	0.604436E+04	0.000000E+00	0.181328E+05	0.290175E+01
	2	0.305326E+03	0.967219E+00	0.604436E+04	0.000000E+00	0.181328E+05	0.290175E+01
CQC	1	0.304100E+03	0.968153E+00	0.666063E+04	0.000000E+00	0.199816E+05	0.290455E+01
	2	0.304100E+03	0.968153E+00	0.666063E+04	0.000000E+00	0.199816E+05	0.290455E+01
GROUPING	1	0.305368E+03	0.967225E+00	0.604930E+04	0.000000E+00	0.181476E+05	0.290176E+01
	2	0.305368E+03	0.967225E+00	0.604930E+04	0.000000E+00	0.181476E+05	0.290176E+01
10 %	1	0.305368E+03	0.967225E+00	0.604930E+04	0.000000E+00	0.181476E+05	0.290176E+01
	2	0.305368E+03	0.967225E+00	0.604930E+04	0.000000E+00	0.181476E+05	0.290176E+01
DOUBLE SUM	1	0.307232E+03	0.968791E+00	0.696984E+04	0.000000E+00	0.209092E+05	0.290646E+01
	2	0.307232E+03	0.968791E+00	0.696984E+04	0.000000E+00	0.209092E+05	0.290646E+01

spatial combination B (R=R1+0.4R2+0.4R3)

SRSS	1	0.305326E+03	0.386888E+00	0.241775E+04	0.000000E+00	0.725312E+04	0.116070E+01
	2	0.305326E+03	0.386888E+00	0.241775E+04	0.000000E+00	0.725312E+04	0.116070E+01
CQC	1	0.304100E+03	0.387261E+00	0.266425E+04	0.000000E+00	0.799262E+04	0.116182E+01
	2	0.304100E+03	0.387261E+00	0.266425E+04	0.000000E+00	0.799262E+04	0.116182E+01
GROUPING	1	0.305368E+03	0.386890E+00	0.241972E+04	0.000000E+00	0.725905E+04	0.116071E+01
	2	0.305368E+03	0.386890E+00	0.241972E+04	0.000000E+00	0.725905E+04	0.116071E+01
10 %	1	0.305368E+03	0.386890E+00	0.241972E+04	0.000000E+00	0.725905E+04	0.116071E+01
	2	0.305368E+03	0.386890E+00	0.241972E+04	0.000000E+00	0.725905E+04	0.116071E+01
DOUBLE SUM	1	0.307232E+03	0.387517E+00	0.278794E+04	0.000000E+00	0.836367E+04	0.116259E+01
	2	0.307232E+03	0.387517E+00	0.278794E+04	0.000000E+00	0.836367E+04	0.116259E+01

spatial combination C (R=0.4R1+R2+0.4R3)

SRSS	1	0.122130E+03	0.967219E+00	0.241775E+04	0.000000E+00	0.725312E+04	0.290175E+01
	2	0.122130E+03	0.967219E+00	0.241775E+04	0.000000E+00	0.725312E+04	0.290175E+01
CQC	1	0.121640E+03	0.968153E+00	0.266425E+04	0.000000E+00	0.799262E+04	0.290455E+01
	2	0.121640E+03	0.968153E+00	0.266425E+04	0.000000E+00	0.799262E+04	0.290455E+01
GROUPING	1	0.122147E+03	0.967225E+00	0.241972E+04	0.000000E+00	0.725905E+04	0.290176E+01
	2	0.122147E+03	0.967225E+00	0.241972E+04	0.000000E+00	0.725905E+04	0.290176E+01
10 %	1	0.122147E+03	0.967225E+00	0.241972E+04	0.000000E+00	0.725905E+04	0.290176E+01
	2	0.122147E+03	0.967225E+00	0.241972E+04	0.000000E+00	0.725905E+04	0.290176E+01
DOUBLE SUM	1	0.122893E+03	0.968791E+00	0.278794E+04	0.000000E+00	0.836367E+04	0.290646E+01
	2	0.122893E+03	0.968791E+00	0.278794E+04	0.000000E+00	0.836367E+04	0.290646E+01

spatial combination D (R=0.4R1+0.4R2+R3)

SRSS	1	0.122130E+03	0.386888E+00	0.604436E+04	0.000000E+00	0.181328E+05	0.116070E+01
	2	0.122130E+03	0.386888E+00	0.604436E+04	0.000000E+00	0.181328E+05	0.116070E+01
CQC	1	0.121640E+03	0.387261E+00	0.666063E+04	0.000000E+00	0.199816E+05	0.116182E+01
	2	0.121640E+03	0.387261E+00	0.666063E+04	0.000000E+00	0.199816E+05	0.116182E+01
GROUPING	1	0.122147E+03	0.386890E+00	0.604930E+04	0.000000E+00	0.181476E+05	0.116071E+01
	2	0.122147E+03	0.386890E+00	0.604930E+04	0.000000E+00	0.181476E+05	0.116071E+01
10 %	1	0.122147E+03	0.386890E+00	0.604930E+04	0.000000E+00	0.181476E+05	0.116071E+01
	2	0.122147E+03	0.386890E+00	0.604930E+04	0.000000E+00	0.181476E+05	0.116071E+01
DOUBLE SUM	1	0.122893E+03	0.387517E+00	0.696984E+04	0.000000E+00	0.209092E+05	0.116259E+01
	2	0.122893E+03	0.387517E+00	0.696984E+04	0.000000E+00	0.209092E+05	0.116259E+01

ELEMENT = 9
spatial combination A (srss)

method	node	Fx	Fy	Fz	Mxx	Myy	Mzz
SRSS	5	0.201124E+04	0.873870E+00	0.503198E+04	0.000000E+00	0.150957E+05	0.262169E+01
	6	0.201124E+04	0.873870E+00	0.503198E+04	0.000000E+00	0.150957E+05	0.262169E+01

CQC	5	0.200992E+04	0.874674E+00	0.557464E+04	0.000000E+00	0.167237E+05	0.262410E+01
	6	0.200992E+04	0.874674E+00	0.557464E+04	0.000000E+00	0.167237E+05	0.262410E+01
GROUPING	5	0.201131E+04	0.873874E+00	0.503249E+04	0.000000E+00	0.150972E+05	0.262170E+01
	6	0.201131E+04	0.873874E+00	0.503249E+04	0.000000E+00	0.150972E+05	0.262170E+01
10 %	5	0.201131E+04	0.873874E+00	0.503249E+04	0.000000E+00	0.150972E+05	0.262170E+01
	6	0.201131E+04	0.873874E+00	0.503249E+04	0.000000E+00	0.150972E+05	0.262170E+01
DOUBLE SUM	5	0.201787E+04	0.875215E+00	0.576970E+04	0.000000E+00	0.173088E+05	0.262573E+01
	6	0.201787E+04	0.875215E+00	0.576970E+04	0.000000E+00	0.173088E+05	0.262573E+01

spatial combination B (R=R1+0.4R2+0.4R3)

SRSS	5	0.201124E+04	0.349548E+00	0.201279E+04	0.000000E+00	0.603828E+04	0.104868E+01
	6	0.201124E+04	0.349548E+00	0.201279E+04	0.000000E+00	0.603828E+04	0.104868E+01
CQC	5	0.200992E+04	0.349870E+00	0.222986E+04	0.000000E+00	0.668946E+04	0.104964E+01
	6	0.200992E+04	0.349870E+00	0.222986E+04	0.000000E+00	0.668946E+04	0.104964E+01
GROUPING	5	0.201131E+04	0.349550E+00	0.201300E+04	0.000000E+00	0.603889E+04	0.104868E+01
	6	0.201131E+04	0.349550E+00	0.201300E+04	0.000000E+00	0.603889E+04	0.104868E+01
10 %	5	0.201131E+04	0.349550E+00	0.201300E+04	0.000000E+00	0.603889E+04	0.104868E+01
	6	0.201131E+04	0.349550E+00	0.201300E+04	0.000000E+00	0.603889E+04	0.104868E+01
DOUBLE SUM	5	0.201787E+04	0.350086E+00	0.230788E+04	0.000000E+00	0.692353E+04	0.105029E+01
	6	0.201787E+04	0.350086E+00	0.230788E+04	0.000000E+00	0.692353E+04	0.105029E+01

spatial combination C (R=0.4R1+R2+0.4R3)

SRSS	5	0.804495E+03	0.873870E+00	0.201279E+04	0.000000E+00	0.603828E+04	0.262169E+01
	6	0.804495E+03	0.873870E+00	0.201279E+04	0.000000E+00	0.603828E+04	0.262169E+01
CQC	5	0.803968E+03	0.874674E+00	0.222986E+04	0.000000E+00	0.668946E+04	0.262410E+01
	6	0.803968E+03	0.874674E+00	0.222986E+04	0.000000E+00	0.668946E+04	0.262410E+01
GROUPING	5	0.804522E+03	0.873874E+00	0.201300E+04	0.000000E+00	0.603889E+04	0.262170E+01
	6	0.804522E+03	0.873874E+00	0.201300E+04	0.000000E+00	0.603889E+04	0.262170E+01
10 %	5	0.804522E+03	0.873874E+00	0.201300E+04	0.000000E+00	0.603889E+04	0.262170E+01
	6	0.804522E+03	0.873874E+00	0.201300E+04	0.000000E+00	0.603889E+04	0.262170E+01
DOUBLE SUM	5	0.807148E+03	0.875215E+00	0.230788E+04	0.000000E+00	0.692353E+04	0.262573E+01
	6	0.807148E+03	0.875215E+00	0.230788E+04	0.000000E+00	0.692353E+04	0.262573E+01

spatial combination D (R=0.4R1+0.4R2+R3)

SRSS	5	0.804495E+03	0.349548E+00	0.503198E+04	0.000000E+00	0.150957E+05	0.104868E+01
	6	0.804495E+03	0.349548E+00	0.503198E+04	0.000000E+00	0.150957E+05	0.104868E+01
CQC	5	0.803968E+03	0.349870E+00	0.557464E+04	0.000000E+00	0.167237E+05	0.104964E+01
	6	0.803968E+03	0.349870E+00	0.557464E+04	0.000000E+00	0.167237E+05	0.104964E+01
GROUPING	5	0.804522E+03	0.349550E+00	0.503249E+04	0.000000E+00	0.150972E+05	0.104868E+01
	6	0.804522E+03	0.349550E+00	0.503249E+04	0.000000E+00	0.150972E+05	0.104868E+01
10 %	5	0.804522E+03	0.349550E+00	0.503249E+04	0.000000E+00	0.150972E+05	0.104868E+01
	6	0.804522E+03	0.349550E+00	0.503249E+04	0.000000E+00	0.150972E+05	0.104868E+01
DOUBLE SUM	5	0.807148E+03	0.350086E+00	0.576970E+04	0.000000E+00	0.173088E+05	0.105029E+01

	6	0.807148E+03	0.350086E+00	0.576970E+04	0.000000E+00	0.173088E+05	0.105029E+01

ELEMENT = 36

spatial combination A (srss)

method	node	Fx	Fy	Fz	Mxx	Myy	Mzz
SRSS	16	0.169044E+02	0.781868E-02	0.000000E+00	0.195469E-01	0.422620E+02	0.000000E+00
	19	0.169044E+02	0.781868E-02	0.000000E+00	0.195469E-01	0.422620E+02	0.000000E+00
CQC	16	0.174385E+02	0.780812E-02	0.000000E+00	0.195205E-01	0.435973E+02	0.000000E+00
	19	0.174385E+02	0.780812E-02	0.000000E+00	0.195205E-01	0.435973E+02	0.000000E+00
GROUPING	16	0.169272E+02	0.782012E-02	0.000000E+00	0.195505E-01	0.423190E+02	0.000000E+00
	19	0.169272E+02	0.782012E-02	0.000000E+00	0.195505E-01	0.423190E+02	0.000000E+00
10 %	16	0.169272E+02	0.782012E-02	0.000000E+00	0.195505E-01	0.423190E+02	0.000000E+00
	19	0.169272E+02	0.782012E-02	0.000000E+00	0.195505E-01	0.423190E+02	0.000000E+00
DOUBLE SUM	16	0.176581E+02	0.783413E-02	0.000000E+00	0.195855E-01	0.441461E+02	0.000000E+00
	19	0.176581E+02	0.783413E-02	0.000000E+00	0.195855E-01	0.441461E+02	0.000000E+00

spatial combination B (R=R1+0.4R2+0.4R3)

method	node	Fx	Fy	Fz	Mxx	Myy	Mzz
SRSS	16	0.169044E+02	0.312747E-02	0.000000E+00	0.781876E-02	0.422620E+02	0.000000E+00
	19	0.169044E+02	0.312747E-02	0.000000E+00	0.781876E-02	0.422620E+02	0.000000E+00
CQC	16	0.174385E+02	0.312325E-02	0.000000E+00	0.780820E-02	0.435973E+02	0.000000E+00
	19	0.174385E+02	0.312325E-02	0.000000E+00	0.780820E-02	0.435973E+02	0.000000E+00
GROUPING	16	0.169272E+02	0.312805E-02	0.000000E+00	0.782020E-02	0.423190E+02	0.000000E+00
	19	0.169272E+02	0.312805E-02	0.000000E+00	0.782020E-02	0.423190E+02	0.000000E+00
10 %	16	0.169272E+02	0.312805E-02	0.000000E+00	0.782020E-02	0.423190E+02	0.000000E+00
	19	0.169272E+02	0.312805E-02	0.000000E+00	0.782020E-02	0.423190E+02	0.000000E+00
DOUBLE SUM	16	0.176581E+02	0.313365E-02	0.000000E+00	0.783421E-02	0.441461E+02	0.000000E+00
	19	0.176581E+02	0.313365E-02	0.000000E+00	0.783421E-02	0.441461E+02	0.000000E+00

spatial combination C (R=0.4R1+R2+0.4R3)

method	node	Fx	Fy	Fz	Mxx	Myy	Mzz
SRSS	16	0.676177E+01	0.781868E-02	0.000000E+00	0.195469E-01	0.169048E+02	0.000000E+00
	19	0.676177E+01	0.781868E-02	0.000000E+00	0.195469E-01	0.169048E+02	0.000000E+00
CQC	16	0.697541E+01	0.780812E-02	0.000000E+00	0.195205E-01	0.174389E+02	0.000000E+00
	19	0.697541E+01	0.780812E-02	0.000000E+00	0.195205E-01	0.174389E+02	0.000000E+00
GROUPING	16	0.677088E+01	0.782012E-02	0.000000E+00	0.195505E-01	0.169276E+02	0.000000E+00
	19	0.677088E+01	0.782012E-02	0.000000E+00	0.195505E-01	0.169276E+02	0.000000E+00
10 %	16	0.677088E+01	0.782012E-02	0.000000E+00	0.195505E-01	0.169276E+02	0.000000E+00
	19	0.677088E+01	0.782012E-02	0.000000E+00	0.195505E-01	0.169276E+02	0.000000E+00
DOUBLE SUM	16	0.706322E+01	0.783413E-02	0.000000E+00	0.195855E-01	0.176585E+02	0.000000E+00
	19	0.706322E+01	0.783413E-02	0.000000E+00	0.195855E-01	0.176585E+02	0.000000E+00

spatial combination D (R=0.4R1+0.4R2+R3)

method	node	Fx	Fy	Fz	Mxx	Myy	Mzz
SRSS	16	0.676177E+01	0.312747E-02	0.000000E+00	0.781876E-02	0.169048E+02	0.000000E+00

	19	0.676177E+01	0.312747E-02	0.000000E+00	0.781876E-02	0.169048E+02	0.000000E+00
CQC	16	0.697541E+01	0.312325E-02	0.000000E+00	0.780820E-02	0.174389E+02	0.000000E+00
	19	0.697541E+01	0.312325E-02	0.000000E+00	0.780820E-02	0.174389E+02	0.000000E+00
GROUPING	16	0.677088E+01	0.312805E-02	0.000000E+00	0.782020E-02	0.169276E+02	0.000000E+00
	19	0.677088E+01	0.312805E-02	0.000000E+00	0.782020E-02	0.169276E+02	0.000000E+00
10 %	16	0.677088E+01	0.312805E-02	0.000000E+00	0.782020E-02	0.169276E+02	0.000000E+00
	19	0.677088E+01	0.312805E-02	0.000000E+00	0.782020E-02	0.169276E+02	0.000000E+00
DOUBLE SUM	16	0.706322E+01	0.313365E-02	0.000000E+00	0.783421E-02	0.176585E+02	0.000000E+00
	19	0.706322E+01	0.313365E-02	0.000000E+00	0.783421E-02	0.176585E+02	0.000000E+00

ELEMENT = 42

spatial combination A (srss)

method	node	Fx	Fy	Fz	Mxx	Myy	Mzz
SRSS	26	0.560734E+05	0.110990E+02	0.762749E+05	0.152546E+06	0.000000E+00	0.112148E+06
	20	0.560734E+05	0.110990E+02	0.762749E+05	0.152546E+06	0.000000E+00	0.112148E+06
CQC	26	0.561151E+05	0.109538E+02	0.841102E+05	0.168216E+06	0.000000E+00	0.112232E+06
	20	0.561151E+05	0.109538E+02	0.841102E+05	0.168216E+06	0.000000E+00	0.112232E+06
GROUPING	26	0.560737E+05	0.111006E+02	0.762985E+05	0.152593E+06	0.000000E+00	0.112149E+06
	20	0.560737E+05	0.111006E+02	0.762985E+05	0.152593E+06	0.000000E+00	0.112149E+06
10 %	26	0.560737E+05	0.111006E+02	0.762985E+05	0.152593E+06	0.000000E+00	0.112149E+06
	20	0.560737E+05	0.111006E+02	0.762985E+05	0.152593E+06	0.000000E+00	0.112149E+06
DOUBLE SUM	26	0.561350E+05	0.112641E+02	0.849811E+05	0.169958E+06	0.000000E+00	0.112272E+06
	20	0.561350E+05	0.112641E+02	0.849811E+05	0.169958E+06	0.000000E+00	0.112272E+06

spatial combination B (R=R1+0.4R2+0.4R3)

SRSS	26	0.560734E+05	0.443960E+01	0.305100E+05	0.610184E+05	0.000000E+00	0.112148E+06
	20	0.560734E+05	0.443960E+01	0.305100E+05	0.610184E+05	0.000000E+00	0.112148E+06
CQC	26	0.561151E+05	0.438153E+01	0.336441E+05	0.672865E+05	0.000000E+00	0.112232E+06
	20	0.561151E+05	0.438153E+01	0.336441E+05	0.672865E+05	0.000000E+00	0.112232E+06
GROUPING	26	0.560737E+05	0.444024E+01	0.305194E+05	0.610373E+05	0.000000E+00	0.112149E+06
	20	0.560737E+05	0.444024E+01	0.305194E+05	0.610373E+05	0.000000E+00	0.112149E+06
10 %	26	0.560737E+05	0.444024E+01	0.305194E+05	0.610373E+05	0.000000E+00	0.112149E+06
	20	0.560737E+05	0.444024E+01	0.305194E+05	0.610373E+05	0.000000E+00	0.112149E+06
DOUBLE SUM	26	0.561350E+05	0.450563E+01	0.339925E+05	0.679832E+05	0.000000E+00	0.112272E+06
	20	0.561350E+05	0.450563E+01	0.339925E+05	0.679832E+05	0.000000E+00	0.112272E+06

spatial combination C (R=0.4R1+R2+0.4R3)

SRSS	26	0.224294E+05	0.110990E+02	0.305100E+05	0.610184E+05	0.000000E+00	0.448594E+05
	20	0.224294E+05	0.110990E+02	0.305100E+05	0.610184E+05	0.000000E+00	0.448594E+05
CQC	26	0.224460E+05	0.109538E+02	0.336441E+05	0.672865E+05	0.000000E+00	0.448927E+05
	20	0.224460E+05	0.109538E+02	0.336441E+05	0.672865E+05	0.000000E+00	0.448927E+05
GROUPING	26	0.224295E+05	0.11100[illegible]E+02	0.305194E+05	0.610373E+05	0.000000E+00	0.448596E+05
	20	0.224295E+05	0.111[illegible]E+02	0.305194E+05	0.610373E+05	0.000000E+00	0.448596E+05

10 %	26	0.224295E+05	0.111006E+02	0.305194E+05	0.610373E+05	0.000000E+00	0.448596E+05
	20	0.224295E+05	0.111006E+02	0.305194E+05	0.610373E+05	0.000000E+00	0.448596E+05
DOUBLE SUM	26	0.224540E+05	0.112641E+02	0.339925E+05	0.679832E+05	0.000000E+00	0.449086E+05
	20	0.224540E+05	0.112641E+02	0.339925E+05	0.679832E+05	0.000000E+00	0.449086E+05

spatial combination D (R=0.4R1+0.4R2+R3)

SRSS	26	0.224294E+05	0.443960E+01	0.762749E+05	0.152546E+06	0.000000E+00	0.448594E+05
	20	0.224294E+05	0.443960E+01	0.762749E+05	0.152546E+06	0.000000E+00	0.448594E+05
CQC	26	0.224460E+05	0.438153E+01	0.841102E+05	0.168216E+06	0.000000E+00	0.448927E+05
	20	0.224460E+05	0.438153E+01	0.841102E+05	0.168216E+06	0.000000E+00	0.448927E+05
GROUPING	26	0.224295E+05	0.444024E+01	0.762985E+05	0.152593E+06	0.000000E+00	0.448596E+05
	20	0.224295E+05	0.444024E+01	0.762985E+05	0.152593E+06	0.000000E+00	0.448596E+05
10 %	26	0.224295E+05	0.444024E+01	0.762985E+05	0.152593E+06	0.000000E+00	0.448596E+05
	20	0.224295E+05	0.444024E+01	0.762985E+05	0.152593E+06	0.000000E+00	0.448596E+05
DOUBLE SUM	26	0.224540E+05	0.450563E+01	0.849811E+05	0.169958E+06	0.000000E+00	0.449086E+05
	20	0.224540E+05	0.450563E+01	0.849811E+05	0.169958E+06	0.000000E+00	0.449086E+05

TABLE 11

Response by T.H.A of Building -2

NODAL DISP. BY THA

method	node	Ux	Uy	Uz	Rxx	Ryy	Rzz
SRSS	1	0.118981E-01	0.493719E-07	0.155931E-01	0.000000E+00	0.000000E+00	0.000000E+00
SRSS	5	0.873774E-02	0.442995E-07	0.111848E-01	0.000000E+00	0.000000E+00	0.000000E+00
SRSS	16	0.172444E-02	0.182495E-07	0.210152E-02	0.000000E+00	0.000000E+00	0.000000E+00
SRSS	19	0.172507E-02	0.180583E-07	0.210152E-02	0.000000E+00	0.000000E+00	0.000000E+00

FORCES in global by T.H.A.

method	node	Fx	Fy	Fz	Mxx	Myy	Mzz
	Element	1					
SRSS	1	0.256205E+03	0.109505E+01	0.631974E+04	0.000000E+00	0.189589E+05	0.328525E+01
	2	0.256205E+03	0.109505E+01	0.631974E+04	0.000000E+00	0.189589E+05	0.328525E+01
	Element	9					
SRSS	5	0.174600E+04	0.985485E+00	0.553787E+04	0.000000E+00	0.166134E+05	0.295655E+01
	6	0.174600E+04	0.985485E+00	0.553787E+04	0.000000E+00	0.166134E+05	0.295655E+01
	Element	36					
SRSS	16	0.171545E+02	0.751957E-02	0.000000E+00	0.187991E-01	0.428871E+02	0.000000E+00
	19	0.171545E+02	0.751957E-02	0.000000E+00	0.187991E-01	0.428871E+02	0.000000E+00
	Element	42					
SRSS	26	0.612923E+05	0.110997E+02	0.928829E+05	0.185761E+06	0.000000E+00	0.122586E+06
	20	0.612923E+05	0.110997E+02	0.928829E+05	0.185761E+06	0.000000E+00	0.122586E+06

TABLE 12

Errors in responses by R.S.T. for building 2

Errors in displacements

SPATIAL COMB 1

method	node	Ux	Uy	Uz			
SRSS	1	-0.4363E-01	-0.1234E+00	0.4247E-01	0.0000E+00	0.0000E+00	0.0000E+00
CQC	1	-0.4366E-01	-0.1161E+00	0.3435E-01	0.0000E+00	0.0000E+00	0.0000E+00
GROUPING	1	-0.4362E-01	-0.1234E+00	0.4247E-01	0.0000E+00	0.0000E+00	0.0000E+00
10 %	1	-0.4362E-01	-0.1234E+00	0.4247E-01	0.0000E+00	0.0000E+00	0.0000E+00
DOUBLE SUM	1	-0.4340E-01	-0.1148E+00	0.5159E-01	0.0000E+00	0.0000E+00	0.0000E+00
SPATIAL COMB 2							
SRSS	1	-0.4363E-01	-0.6494E+00	-0.5830E+00	0.0000E+00	0.0000E+00	0.0000E+00
CQC	1	-0.4366E-01	-0.6464E+00	-0.5863E+00	0.0000E+00	0.0000E+00	0.0000E+00
GROUPING	1	-0.4362E-01	-0.6494E+00	-0.5830E+00	0.0000E+00	0.0000E+00	0.0000E+00
10 %	1	-0.4362E-01	-0.6494E+00	-0.5830E+00	0.0000E+00	0.0000E+00	0.0000E+00
DOUBLE SUM	1	-0.4340E-01	-0.6459E+00	-0.5794E+00	0.0000E+00	0.0000E+00	0.0000E+00
SPATIAL COMB 3							
SRSS	1	-0.6175E+00	-0.1234E+00	-0.5830E+00	0.0000E+00	0.0000E+00	0.0000E+00
CQC	1	-0.6175E+00	-0.1161E+00	-0.5863E+00	0.0000E+00	0.0000E+00	0.0000E+00
GROUPING	1	-0.6175E+00	-0.1234E+00	-0.5830E+00	0.0000E+00	0.0000E+00	0.0000E+00
10 %	1	-0.6175E+00	-0.1234E+00	-0.5830E+00	0.0000E+00	0.0000E+00	0.0000E+00
DOUBLE SUM	1	-0.6174E+00	-0.1148E+00	-0.5794E+00	0.0000E+00	0.0000E+00	0.0000E+00
SPATIAL COMB 4							
SRSS	1	-0.6175E+00	-0.6494E+00	0.4247E-01	0.0000E+00	0.0000E+00	0.0000E+00
CQC	1	-0.6175E+00	-0.6464E+00	0.3435E-01	0.0000E+00	0.0000E+00	0.0000E+00
GROUPING	1	-0.6175E+00	-0.6494E+00	0.4247E-01	0.0000E+00	0.0000E+00	0.0000E+00
10 %	1	-0.6175E+00	-0.6494E+00	0.4247E-01	0.0000E+00	0.0000E+00	0.0000E+00
DOUBLE SUM	1	-0.6174E+00	-0.6459E+00	0.5159E-01	0.0000E+00	0.0000E+00	0.0000E+00
SPATIAL COMB 1							
SRSS	5	-0.5552E-01	-0.1202E+00	0.2985E-01	0.0000E+00	0.0000E+00	0.0000E+00
CQC	5	-0.5545E-01	-0.1129E+00	0.2316E-01	0.0000E+00	0.0000E+00	0.0000E+00
GROUPING	5	-0.5552E-01	-0.1202E+00	0.2985E-01	0.0000E+00	0.0000E+00	0.0000E+00
10 %	5	-0.5552E-01	-0.1202E+00	0.2985E-01	0.0000E+00	0.0000E+00	0.0000E+00
DOUBLE SUM	5	-0.5543E-01	-0.1116E+00	0.3741E-01	0.0000E+00	0.0000E+00	0.0000E+00

SPATIAL COMB 2

SRSS	5	-0.5552E-01	-0.6481E+00	-0.5881E+00	0.0000E+00	0.0000E+00	0.0000E+00
CQC	5	-0.5545E-01	-0.6452E+00	-0.5907E+00	0.0000E+00	0.0000E+00	0.0000E+00
GROUPING	5	-0.5552E-01	-0.6481E+00	-0.5881E+00	0.0000E+00	0.0000E+00	0.0000E+00
10 %	5	-0.5552E-01	-0.6481E+00	-0.5881E+00	0.0000E+00	0.0000E+00	0.0000E+00
DOUBLE SUM	5	-0.5543E-01	-0.6446E+00	-0.5850E+00	0.0000E+00	0.0000E+00	0.0000E+00

SPATIAL COMB 3

SRSS	5	-0.6222E+00	-0.1202E+00	-0.5881E+00	0.0000E+00	0.0000E+00	0.0000E+00
CQC	5	-0.6222E+00	-0.1129E+00	-0.5907E+00	0.0000E+00	0.0000E+00	0.0000E+00
GROUPING	5	-0.6222E+00	-0.1202E+00	-0.5881E+00	0.0000E+00	0.0000E+00	0.0000E+00
10 %	5	-0.6222E+00	-0.1202E+00	-0.5881E+00	0.0000E+00	0.0000E+00	0.0000E+00
DOUBLE SUM	5	-0.6222E+00	-0.1116E+00	-0.5850E+00	0.0000E+00	0.0000E+00	0.0000E+00

SPATIAL COMB 4

SRSS	5	-0.6222E+00	-0.6481E+00	0.2985E-01	0.0000E+00	0.0000E+00	0.0000E+00
CQC	5	-0.6222E+00	-0.6452E+00	0.2316E-01	0.0000E+00	0.0000E+00	0.0000E+00
GROUPING	5	-0.6222E+00	-0.6481E+00	0.2985E-01	0.0000E+00	0.0000E+00	0.0000E+00
10 %	5	-0.6222E+00	-0.6481E+00	0.2985E-01	0.0000E+00	0.0000E+00	0.0000E+00
DOUBLE SUM	5	-0.6222E+00	-0.6446E+00	0.3741E-01	0.0000E+00	0.0000E+00	0.0000E+00

SPATIAL COMB 1

SRSS	16	-0.8409E-01	-0.1041E+00	-0.1347E-01	0.0000E+00	0.0000E+00	0.0000E+00
CQC	16	-0.8376E-01	-0.9658E-01	-0.1596E-01	0.0000E+00	0.0000E+00	0.0000E+00
GROUPING	16	-0.8409E-01	-0.1041E+00	-0.1336E-01	0.0000E+00	0.0000E+00	0.0000E+00
10 %	16	-0.8409E-01	-0.1041E+00	-0.1336E-01	0.0000E+00	0.0000E+00	0.0000E+00
DOUBLE SUM	16	-0.8348E-01	-0.9543E-01	-0.9627E-02	0.0000E+00	0.0000E+00	0.0000E+00

SPATIAL COMB 2

SRSS	16	-0.8409E-01	-0.6416E+00	-0.6054E+00	0.0000E+00	0.0000E+00	0.0000E+00
CQC	16	-0.8376E-01	-0.6386E+00	-0.6064E+00	0.0000E+00	0.0000E+00	0.0000E+00
GROUPING	16	-0.8409E-01	-0.6416E+00	-0.6053E+00	0.0000E+00	0.0000E+00	0.0000E+00
10 %	16	-0.8409E-01	-0.6416E+00	-0.6053E+00	0.0000E+00	0.0000E+00	0.0000E+00
DOUBLE SUM	16	-0.8348E-01	-0.6382E+00	-0.6039E+00	0.0000E+00	0.0000E+00	0.0000E+00

SPATIAL COMB 3

SRSS	16	-0.6336E+00	-0.1041E+00	-0.6054E+00	0.0000E+00	0.0000E+00	0.0000E+00
CQC	16	-0.6335E+00	-0.9658E-01	-0.6064E+00	0.0000E+00	0.0000E+00	0.0000E+00
GROUPING	16	-0.6336E+00	-0.1041E+00	-0.6053E+00	0.0000E+00	0.0000E+00	0.0000E+00

10 %	16	-0.6336E+00	-0.1041E+00	-0.6053E+00	0.0000E+00	0.0000E+00	0.0000E+00
DOUBLE SUM	16	-0.6334E+00	-0.9543E-01	-0.6039E+00	0.0000E+00	0.0000E+00	0.0000E+00

SPATIAL COMB 4

SRSS	16	-0.6336E+00	-0.6416E+00	-0.1347E-01	0.0000E+00	0.0000E+00	0.0000E+00
CQC	16	-0.6335E+00	-0.6386E+00	-0.1596E-01	0.0000E+00	0.0000E+00	0.0000E+00
GROUPING	16	-0.6336E+00	-0.6416E+00	-0.1336E-01	0.0000E+00	0.0000E+00	0.0000E+00
10 %	16	-0.6336E+00	-0.6416E+00	-0.1336E-01	0.0000E+00	0.0000E+00	0.0000E+00
DOUBLE SUM	16	-0.6334E+00	-0.6382E+00	-0.9627E-02	0.0000E+00	0.0000E+00	0.0000E+00

SPATIAL COMB 1

SRSS	19	-0.8430E-01	-0.9411E-01	-0.1347E-01	0.0000E+00	0.0000E+00	0.0000E+00
CQC	19	-0.8364E-01	-0.1004E+00	-0.1596E-01	0.0000E+00	0.0000E+00	0.0000E+00
GROUPING	19	-0.8430E-01	-0.9410E-01	-0.1336E-01	0.0000E+00	0.0000E+00	0.0000E+00
10 %	19	-0.8430E-01	-0.9410E-01	-0.1336E-01	0.0000E+00	0.0000E+00	0.0000E+00
DOUBLE SUM	19	-0.8332E-01	-0.8573E-01	-0.9627E-02	0.0000E+00	0.0000E+00	0.0000E+00

SPATIAL COMB 2

SRSS	19	-0.8430E-01	-0.6376E+00	-0.6054E+00	0.0000E+00	0.0000E+00	0.0000E+00
CQC	19	-0.8364E-01	-0.6402E+00	-0.6064E+00	0.0000E+00	0.0000E+00	0.0000E+00
GROUPING	19	-0.8430E-01	-0.6376E+00	-0.6053E+00	0.0000E+00	0.0000E+00	0.0000E+00
10 %	19	-0.8430E-01	-0.6376E+00	-0.6053E+00	0.0000E+00	0.0000E+00	0.0000E+00
DOUBLE SUM	19	-0.8332E-01	-0.6343E+00	-0.6039E+00	0.0000E+00	0.0000E+00	0.0000E+00

SPATIAL COMB 3

SRSS	19	-0.6337E+00	-0.9411E-01	-0.6054E+00	0.0000E+00	0.0000E+00	0.0000E+00
CQC	19	-0.6335E+00	-0.1004E+00	-0.6064E+00	0.0000E+00	0.0000E+00	0.0000E+00
GROUPING	19	-0.6337E+00	-0.9410E-01	-0.6053E+00	0.0000E+00	0.0000E+00	0.0000E+00
10 %	19	-0.6337E+00	-0.9410E-01	-0.6053E+00	0.0000E+00	0.0000E+00	0.0000E+00
DOUBLE SUM	19	-0.6333E+00	-0.8573E-01	-0.6039E+00	0.0000E+00	0.0000E+00	0.0000E+00

SPATIAL COMB 4

SRSS	19	-0.6337E+00	-0.6376E+00	-0.1347E-01	0.0000E+00	0.0000E+00	0.0000E+00
CQC	19	-0.6335E+00	-0.6402E+00	-0.1596E-01	0.0000E+00	0.0000E+00	0.0000E+00
GROUPING	19	-0.6337E+00	-0.6376E+00	-0.1336E-01	0.0000E+00	0.0000E+00	0.0000E+00
10 %	19	-0.6337E+00	-0.6376E+00	-0.1336E-01	0.0000E+00	0.0000E+00	0.0000E+00
DOUBLE SUM	19	-0.6333E+00	-0.6343E+00	-0.9627E-02	0.0000E+00	0.0000E+00	0.0000E+00

Error in forces

Element 1

SPATIAL COMB 1							
SRSS	1	0.1917E+00	-0.1167E+00	-0.4358E-01	0.0000E+00	-0.4357E-01	-0.1167E+00
	2	0.1917E+00	-0.1167E+00	-0.4358E-01	0.0000E+00	-0.4357E-01	-0.1167E+00
CQC	1	0.1869E+00	-0.1159E+00	0.5394E-01	0.0000E+00	0.5394E-01	-0.1159E+00
	2	0.1869E+00	-0.1159E+00	0.5394E-01	0.0000E+00	0.5394E-01	-0.1159E+00
GROUPING	1	0.1919E+00	-0.1167E+00	-0.4279E-01	0.0000E+00	-0.4279E-01	-0.1167E+00
	2	0.1919E+00	-0.1167E+00	-0.4279E-01	0.0000E+00	-0.4279E-01	-0.1167E+00
10 %	1	0.1919E+00	-0.1167E+00	-0.4279E-01	0.0000E+00	-0.4279E-01	-0.1167E+00
	2	0.1919E+00	-0.1167E+00	-0.4279E-01	0.0000E+00	-0.4279E-01	-0.1167E+00
DOUBLE SUM	1	0.1992E+00	-0.1153E+00	0.1029E+00	0.0000E+00	0.1029E+00	-0.1153E+00
	2	0.1992E+00	-0.1153E+00	0.1029E+00	0.0000E+00	0.1029E+00	-0.1153E+00
SPATIAL COMB 2							
SRSS	1	0.1917E+00	-0.6467E+00	-0.6174E+00	0.0000E+00	-0.6174E+00	-0.6467E+00
	2	0.1917E+00	-0.6467E+00	-0.6174E+00	0.0000E+00	-0.6174E+00	-0.6467E+00
CQC	1	0.1869E+00	-0.6464E+00	-0.5784E+00	0.0000E+00	-0.5784E+00	-0.6464E+00
	2	0.1869E+00	-0.6464E+00	-0.5784E+00	0.0000E+00	-0.5784E+00	-0.6464E+00
GROUPING	1	0.1919E+00	-0.6467E+00	-0.6171E+00	0.0000E+00	-0.6171E+00	-0.6467E+00
	2	0.1919E+00	-0.6467E+00	-0.6171E+00	0.0000E+00	-0.6171E+00	-0.6467E+00
10 %	1	0.1919E+00	-0.6467E+00	-0.6171E+00	0.0000E+00	-0.6171E+00	-0.6467E+00
	2	0.1919E+00	-0.6467E+00	-0.6171E+00	0.0000E+00	-0.6171E+00	-0.6467E+00
DOUBLE SUM	1	0.1992E+00	-0.6461E+00	-0.5589E+00	0.0000E+00	-0.5589E+00	-0.6461E+00
	2	0.1992E+00	-0.6461E+00	-0.5589E+00	0.0000E+00	-0.5589E+00	-0.6461E+00
SPATIAL COMB 3							
SRSS	1	-0.5233E+00	-0.1167E+00	-0.6174E+00	0.0000E+00	-0.6174E+00	-0.1167E+00
	2	-0.5233E+00	-0.1167E+00	-0.6174E+00	0.0000E+00	-0.6174E+00	-0.1167E+00
CQC	1	-0.5252E+00	-0.1159E+00	-0.5784E+00	0.0000E+00	-0.5784E+00	-0.1159E+00
	2	-0.5252E+00	-0.1159E+00	-0.5784E+00	0.0000E+00	-0.5784E+00	-0.1159E+00
GROUPING	1	-0.5233E+00	-0.1167E+00	-0.6171E+00	0.0000E+00	-0.6171E+00	-0.1167E+00
	2	-0.5233E+00	-0.1167E+00	-0.6171E+00	0.0000E+00	-0.6171E+00	-0.1167E+00
10 %	1	-0.5233E+00	-0.1167E+00	-0.6171E+00	0.0000E+00	-0.6171E+00	-0.1167E+00
	2	-0.5233E+00	-0.1167E+00	-0.6171E+00	0.0000E+00	-0.6171E+00	-0.1167E+00
DOUBLE SUM	1	-0.5203E+00	-0.1153E+00	-0.5589E+00	0.0000E+00	-0.5589E+00	-0.1153E+00
	2	-0.5203E+00	-0.1153E+00	-0.5589E+00	0.0000E+00	-0.5589E+00	-0.1153E+00
SPATIAL COMB 4							
SRSS	1	-0.5233E+00	-0.6467E+00	-0.4358E-01	0.0000E+00	-0.4357E-01	-0.6467E+00
	2	-0.5233E+00	-0.6467E+00	-0.4358E-01	0.0000E+00	-0.4357E-01	-0.6467E+00
CQC	1	-0.5252E+00	-0.6464E+00	0.5394E-01	0.0000E+00	0.5394E-01	-0.6464E+00
	2	-0.5252E+00	-0.6464E+00	0.5394E-01	0.0000E+00	0.5394E-01	-0.6464E+00

GROUPING	1	-0.5233E+00	-0.6467E+00	-0.4279E-01	0.0000E+00	-0.4279E-01	-0.6467E+00
	2	-0.5233E+00	-0.6467E+00	-0.4279E-01	0.0000E+00	-0.4279E-01	-0.6467E+00
10 %	1	-0.5233E+00	-0.6467E+00	-0.4279E-01	0.0000E+00	-0.4279E-01	-0.6467E+00
	2	-0.5233E+00	-0.6467E+00	-0.4279E-01	0.0000E+00	-0.4279E-01	-0.6467E+00
DOUBLE SUM	1	-0.5203E+00	-0.6461E+00	0.1029E+00	0.0000E+00	0.1029E+00	-0.6461E+00
	2	-0.5203E+00	-0.6461E+00	0.1029E+00	0.0000E+00	0.1029E+00	-0.6461E+00

Element 9

SPATIAL COMB 1

SRSS	5	0.1519E+00	-0.1133E+00	-0.9135E-01	0.0000E+00	-0.9135E-01	-0.1133E+00
	6	0.1519E+00	-0.1133E+00	-0.9135E-01	0.0000E+00	-0.9135E-01	-0.1133E+00
CQC	5	0.1512E+00	-0.1124E+00	0.6640E-02	0.0000E+00	0.6639E-02	-0.1125E+00
	6	0.1512E+00	-0.1124E+00	0.6640E-02	0.0000E+00	0.6639E-02	-0.1125E+00
GROUPING	5	0.1520E+00	-0.1133E+00	-0.9126E-01	0.0000E+00	-0.9126E-01	-0.1133E+00
	6	0.1520E+00	-0.1133E+00	-0.9126E-01	0.0000E+00	-0.9126E-01	-0.1133E+00
10 %	5	0.1520E+00	-0.1133E+00	-0.9126E-01	0.0000E+00	-0.9126E-01	-0.1133E+00
	6	0.1520E+00	-0.1133E+00	-0.9126E-01	0.0000E+00	-0.9126E-01	-0.1133E+00
DOUBLE SUM	5	0.1557E+00	-0.1119E+00	0.4186E-01	0.0000E+00	0.4186E-01	-0.1119E+00
	6	0.1557E+00	-0.1119E+00	0.4186E-01	0.0000E+00	0.4186E-01	-0.1119E+00

SPATIAL COMB 2

SRSS	5	0.1519E+00	-0.6453E+00	-0.6365E+00	0.0000E+00	-0.6365E+00	-0.6453E+00
	6	0.1519E+00	-0.6453E+00	-0.6365E+00	0.0000E+00	-0.6365E+00	-0.6453E+00
CQC	5	0.1512E+00	-0.6450E+00	-0.5973E+00	0.0000E+00	-0.5974E+00	-0.6450E+00
	6	0.1512E+00	-0.6450E+00	-0.5973E+00	0.0000E+00	-0.5974E+00	-0.6450E+00
GROUPING	5	0.1520E+00	-0.6453E+00	-0.6365E+00	0.0000E+00	-0.6365E+00	-0.6453E+00
	6	0.1520E+00	-0.6453E+00	-0.6365E+00	0.0000E+00	-0.6365E+00	-0.6453E+00
10 %	5	0.1520E+00	-0.6453E+00	-0.6365E+00	0.0000E+00	-0.6365E+00	-0.6453E+00
	6	0.1520E+00	-0.6453E+00	-0.6365E+00	0.0000E+00	-0.6365E+00	-0.6453E+00
DOUBLE SUM	5	0.1557E+00	-0.6448E+00	-0.5833E+00	0.0000E+00	-0.5833E+00	-0.6448E+00
	6	0.1557E+00	-0.6448E+00	-0.5833E+00	0.0000E+00	-0.5833E+00	-0.6448E+00

SPATIAL COMB 3

SRSS	5	-0.5392E+00	-0.1133E+00	-0.6365E+00	0.0000E+00	-0.6365E+00	-0.1133E+00
	6	-0.5392E+00	-0.1133E+00	-0.6365E+00	0.0000E+00	-0.6365E+00	-0.1133E+00
CQC	5	-0.5395E+00	-0.1124E+00	-0.5973E+00	0.0000E+00	-0.5974E+00	-0.1125E+00
	6	-0.5395E+00	-0.1124E+00	-0.5973E+00	0.0000E+00	-0.5974E+00	-0.1125E+00
GROUPING	5	-0.5392E+00	-0.1133E+00	-0.6365E+00	0.0000E+00	-0.6365E+00	-0.1133E+00
	6	-0.5392E+00	-0.1133E+00	-0.6365E+00	0.0000E+00	-0.6365E+00	-0.1133E+00
10 %	5	-0.5392E+00	-0.1133E+00	-0.6365E+00	0.0000E+00	-0.6365E+00	-0.1133E+00
	6	-0.5392E+00	-0.1133E+00	-0.6365E+00	0.0000E+00	-0.6365E+00	-0.1133E+00
DOUBLE SUM	5	-0.5377E+00	-0.1119E+00	-0.5833E+00	0.0000E+00	-0.5833E+00	-0.1119E+00
	6	-0.5377E+00	-0.1119E+00	-0.5833E+00	0.0000E+00	-0.5833E+00	-0.1119E+00

SPATIAL COMB 4

SRSS	5	-0.5392E+00	-0.6453E+00	-0.9135E-01	0.0000E+00	-0.9135E-01	-0.6453E+00
	6	-0.5392E+00	-0.6453E+00	-0.9135E-01	0.0000E+00	-0.9135E-01	-0.6453E+00
CQC	5	-0.5395E+00	-0.6450E+00	0.6640E-02	0.0000E+00	0.6639E-02	-0.6450E+00
	6	-0.5395E+00	-0.6450E+00	0.6640E-02	0.0000E+00	0.6639E-02	-0.6450E+00
GROUPING	5	-0.5392E+00	-0.6453E+00	-0.9126E-01	0.0000E+00	-0.9126E-01	-0.6453E+00
	6	-0.5392E+00	-0.6453E+00	-0.9126E-01	0.0000E+00	-0.9126E-01	-0.6453E+00
10 %	5	-0.5392E+00	-0.6453E+00	-0.9126E-01	0.0000E+00	-0.9126E-01	-0.6453E+00
	6	-0.5392E+00	-0.6453E+00	-0.9126E-01	0.0000E+00	-0.9126E-01	-0.6453E+00
DOUBLE SUM	5	-0.5377E+00	-0.6448E+00	0.4186E-01	0.0000E+00	0.4186E-01	-0.6448E+00
	6	-0.5377E+00	-0.6448E+00	0.4186E-01	0.0000E+00	0.4186E-01	-0.6448E+00

Element 36
SPATIAL COMB 1

SRSS	16	-0.1458E-01	0.3978E-01	0.0000E+00	0.3978E-01	-0.1458E-01	0.0000E+00
	19	-0.1458E-01	0.3978E-01	0.0000E+00	0.3978E-01	-0.1458E-01	0.0000E+00
CQC	16	0.1656E-01	0.3837E-01	0.0000E+00	0.3837E-01	0.1656E-01	0.0000E+00
	19	0.1656E-01	0.3837E-01	0.0000E+00	0.3837E-01	0.1656E-01	0.0000E+00
GROUPING	16	-0.1325E-01	0.3997E-01	0.0000E+00	0.3997E-01	-0.1325E-01	0.0000E+00
	19	-0.1325E-01	0.3997E-01	0.0000E+00	0.3997E-01	-0.1325E-01	0.0000E+00
10 %	16	-0.1325E-01	0.3997E-01	0.0000E+00	0.3997E-01	-0.1325E-01	0.0000E+00
	19	-0.1325E-01	0.3997E-01	0.0000E+00	0.3997E-01	-0.1325E-01	0.0000E+00
DOUBLE SUM	16	0.2936E-01	0.4183E-01	0.0000E+00	0.4183E-01	0.2936E-01	0.0000E+00
	19	0.2936E-01	0.4183E-01	0.0000E+00	0.4183E-01	0.2936E-01	0.0000E+00

SPATIAL COMB 2

SRSS	16	-0.1458E-01	-0.5841E+00	0.0000E+00	-0.5841E+00	-0.1458E-01	0.0000E+00
	19	-0.1458E-01	-0.5841E+00	0.0000E+00	-0.5841E+00	-0.1458E-01	0.0000E+00
CQC	16	0.1656E-01	-0.5847E+00	0.0000E+00	-0.5847E+00	0.1656E-01	0.0000E+00
	19	0.1656E-01	-0.5847E+00	0.0000E+00	-0.5847E+00	0.1656E-01	0.0000E+00
GROUPING	16	-0.1325E-01	-0.5840E+00	0.0000E+00	-0.5840E+00	-0.1325E-01	0.0000E+00
	19	-0.1325E-01	-0.5840E+00	0.0000E+00	-0.5840E+00	-0.1325E-01	0.0000E+00
10 %	16	-0.1325E-01	-0.5840E+00	0.0000E+00	-0.5840E+00	-0.1325E-01	0.0000E+00
	19	-0.1325E-01	-0.5840E+00	0.0000E+00	-0.5840E+00	-0.1325E-01	0.0000E+00
DOUBLE SUM	16	0.2936E-01	-0.5833E+00	0.0000E+00	-0.5833E+00	0.2936E-01	0.0000E+00
	19	0.2936E-01	-0.5833E+00	0.0000E+00	-0.5833E+00	0.2936E-01	0.0000E+00

SPATIAL COMB 3

SRSS	16	-0.6058E+00	0.3978E-01	0.0000E+00	0.3978E-01	-0.6058E+00	0.0000E+00
	19	-0.6058E+00	0.3978E-01	0.0000E+00	0.3978E-01	-0.6058E+00	0.0000E+00
CQC	16	-0.5934E+00	0.3837E-01	0.0000E+00	0.3837E-01	-0.5934E+00	0.0000E+00

	19	-0.5934E+00	0.3837E-01	0.0000E+00	0.3837E-01	-0.5934E+00	0.0000E+00
GROUPING	16	-0.6053E+00	0.3997E-01	0.0000E+00	0.3997E-01	-0.6053E+00	0.0000E+00
	19	-0.6053E+00	0.3997E-01	0.0000E+00	0.3997E-01	-0.6053E+00	0.0000E+00
10 %	16	-0.6053E+00	0.3997E-01	0.0000E+00	0.3997E-01	-0.6053E+00	0.0000E+00
	19	-0.6053E+00	0.3997E-01	0.0000E+00	0.3997E-01	-0.6053E+00	0.0000E+00
DOUBLE SUM	16	-0.5883E+00	0.4183E-01	0.0000E+00	0.4183E-01	-0.5883E+00	0.0000E+00
	19	-0.5883E+00	0.4183E-01	0.0000E+00	0.4183E-01	-0.5883E+00	0.0000E+00

SPATIAL COMB 4

SRSS	16	-0.6058E+00	-0.5841E+00	0.0000E+00	-0.5841E+00	-0.6058E+00	0.0000E+00
	19	-0.6058E+00	-0.5841E+00	0.0000E+00	-0.5841E+00	-0.6058E+00	0.0000E+00
CQC	16	-0.5934E+00	-0.5847E+00	0.0000E+00	-0.5847E+00	-0.5934E+00	0.0000E+00
	19	-0.5934E+00	-0.5847E+00	0.0000E+00	-0.5847E+00	-0.5934E+00	0.0000E+00
GROUPING	16	-0.6053E+00	-0.5840E+00	0.0000E+00	-0.5840E+00	-0.6053E+00	0.0000E+00
	19	-0.6053E+00	-0.5840E+00	0.0000E+00	-0.5840E+00	-0.6053E+00	0.0000E+00
10 %	16	-0.6053E+00	-0.5840E+00	0.0000E+00	-0.5840E+00	-0.6053E+00	0.0000E+00
	19	-0.6053E+00	-0.5840E+00	0.0000E+00	-0.5840E+00	-0.6053E+00	0.0000E+00
DOUBLE SUM	16	-0.5883E+00	-0.5833E+00	0.0000E+00	-0.5833E+00	-0.5883E+00	0.0000E+00
	19	-0.5883E+00	-0.5833E+00	0.0000E+00	-0.5833E+00	-0.5883E+00	0.0000E+00

Element 42
SPATIAL COMB 1

SRSS	26	-0.8515E-01	-0.6306E-04	-0.1788E+00	-0.1788E+00	0.0000E+00	-0.8515E-01
	20	-0.8515E-01	-0.6306E-04	-0.1788E+00	-0.1788E+00	0.0000E+00	-0.8515E-01
CQC	26	-0.8447E-01	-0.1314E-01	-0.9445E-01	-0.9445E-01	0.0000E+00	-0.8446E-01
	20	-0.8447E-01	-0.1314E-01	-0.9445E-01	-0.9445E-01	0.0000E+00	-0.8446E-01
GROUPING	26	-0.8514E-01	0.8111E-04	-0.1786E+00	-0.1786E+00	0.0000E+00	-0.8514E-01
	20	-0.8514E-01	0.8111E-04	-0.1786E+00	-0.1786E+00	0.0000E+00	-0.8514E-01
10 %	26	-0.8514E-01	0.8111E-04	-0.1786E+00	-0.1786E+00	0.0000E+00	-0.8514E-01
	20	-0.8514E-01	0.8111E-04	-0.1786E+00	-0.1786E+00	0.0000E+00	-0.8514E-01
DOUBLE SUM	26	-0.8414E-01	0.1481E-01	-0.8507E-01	-0.8507E-01	0.0000E+00	-0.8414E-01
	20	-0.8414E-01	0.1481E-01	-0.8507E-01	-0.8507E-01	0.0000E+00	-0.8414E-01

SPATIAL COMB 2

SRSS	26	-0.8515E-01	-0.6000E+00	-0.6715E+00	-0.6715E+00	0.0000E+00	-0.8515E-01
	20	-0.8515E-01	-0.6000E+00	-0.6715E+00	-0.6715E+00	0.0000E+00	-0.8515E-01
CQC	26	-0.8447E-01	-0.6053E+00	-0.6378E+00	-0.6378E+00	0.0000E+00	-0.8446E-01
	20	-0.8447E-01	-0.6053E+00	-0.6378E+00	-0.6378E+00	0.0000E+00	-0.8446E-01
GROUPING	26	-0.8514E-01	-0.6000E+00	-0.6714E+00	-0.6714E+00	0.0000E+00	-0.8514E-01
	20	-0.8514E-01	-0.6000E+00	-0.6714E+00	-0.6714E+00	0.0000E+00	-0.8514E-01
10 %	26	-0.8514E-01	-0.6000E+00	-0.6714E+00	-0.6714E+00	0.0000E+00	-0.8514E-01
	20	-0.8514E-01	-0.6000E+00	-0.6714E+00	-0.6714E+00	0.0000E+00	-0.8514E-01
DOUBLE SUM	26	-0.8414E-01	-0.5941E+00	-0.6340E+00	-0.6340E+00	0.0000E+00	-0.8414E-01

	20	-0.8414E-01	-0.5941E+00	-0.6340E+00	-0.6340E+00	0.0000E+00	-0.8414E-01

SPATIAL COMB 3

SRSS	26	-0.6341E+00	-0.6306E-04	-0.6715E+00	-0.6715E+00	0.0000E+00	-0.6341E+00
	20	-0.6341E+00	-0.6306E-04	-0.6715E+00	-0.6715E+00	0.0000E+00	-0.6341E+00
CQC	26	-0.6338E+00	-0.1314E-01	-0.6378E+00	-0.6378E+00	0.0000E+00	-0.6338E+00
	20	-0.6338E+00	-0.1314E-01	-0.6378E+00	-0.6378E+00	0.0000E+00	-0.6338E+00
GROUPING	26	-0.6341E+00	0.8111E-04	-0.6714E+00	-0.6714E+00	0.0000E+00	-0.6341E+00
	20	-0.6341E+00	0.8111E-04	-0.6714E+00	-0.6714E+00	0.0000E+00	-0.6341E+00
10 %	26	-0.6341E+00	0.8111E-04	-0.6714E+00	-0.6714E+00	0.0000E+00	-0.6341E+00
	20	-0.6341E+00	0.8111E-04	-0.6714E+00	-0.6714E+00	0.0000E+00	-0.6341E+00
DOUBLE SUM	26	-0.6337E+00	0.1481E-01	-0.6340E+00	-0.6340E+00	0.0000E+00	-0.6337E+00
	20	-0.6337E+00	0.1481E-01	-0.6340E+00	-0.6340E+00	0.0000E+00	-0.6337E+00

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SRSS	26	-0.6341E+00	-0.6000E+00	-0.1788E+00	-0.1788E+00	0.0000E+00	-0.6341E+00
	20	-0.6341E+00	-0.6000E+00	-0.1788E+00	-0.1788E+00	0.0000E+00	-0.6341E+00
CQC	26	-0.6338E+00	-0.6053E+00	-0.9445E-01	-0.9445E-01	0.0000E+00	-0.6338E+00
	20	-0.6338E+00	-0.6053E+00	-0.9445E-01	-0.9445E-01	0.0000E+00	-0.6338E+00
GROUPING	26	-0.6341E+00	-0.6000E+00	-0.1786E+00	-0.1786E+00	0.0000E+00	-0.6341E+00
	20	-0.6341E+00	-0.6000E+00	-0.1786E+00	-0.1786E+00	0.0000E+00	-0.6341E+00
10 %	26	-0.6341E+00	-0.6000E+00	-0.1786E+00	-0.1786E+00	0.0000E+00	-0.6341E+00
	20	-0.6341E+00	-0.6000E+00	-0.1786E+00	-0.1786E+00	0.0000E+00	-0.6341E+00
DOUBLE SUM	26	-0.6337E+00	-0.5941E+00	-0.8507E-01	-0.8507E-01	0.0000E+00	-0.6337E+00
	20	-0.6337E+00	-0.5941E+00	-0.8507E-01	-0.8507E-01	0.0000E+00	-0.6337E+00

TABLE - 13
Properties of modes of Building 3

```
---------------------------------------------------------------------------
mode   1   1 fr=  0.40937E+01 dp=  0.0500 px=  0.17874E-01  py=  0.89577E-09  pz=  0.12431E+01
mx=  0.18103E-03  my=  0.45467E-18  mz=  0.87562E+00 cmx=  0.18103E-03 cmy=  0.45467E-18 cmz=  0.87562E+00
mode   2   2 fr=  0.49587E+01 dp=  0.0500 px=  0.12533E+01  py= -0.19940E-08  pz=  0.36439E-05
mx=  0.85590E+00  my=  0.21666E-17  mz=  0.72351E-11 cmx=  0.85609E+00 cmy=  0.26212E-17 cmz=  0.87562E+00
mode   3   3 fr=  0.56072E+01 dp=  0.0500 px=  0.84403E-04  py= -0.13821E-08  pz= -0.38363E-04
mx=  0.80906E-08  my=  0.21694E-17  mz=  0.16715E-08 cmx=  0.85609E+00 cmy=  0.47907E-17 cmz=  0.87562E+00
mode   4   4 fr=  0.12585E+02 dp=  0.0500 px=  0.10129E-05  py=  0.28430E-08  pz= -0.38622E+00
mx=  0.70240E-12  my=  0.55338E-17  mz=  0.10213E+00 cmx=  0.85609E+00 cmy=  0.10325E-16 cmz=  0.97775E+00
mode   5   5 fr=  0.16128E+02 dp=  0.0500 px= -0.39574E+00  py=  0.36413E-08  pz=  0.20789E-06
mx=  0.11523E+00  my=  0.97553E-17  mz=  0.31799E-13 cmx=  0.97131E+00 cmy=  0.20080E-16 cmz=  0.97775E+00
mode   8   6 fr=  0.20449E+02 dp=  0.0500 px=  0.85956E-07  py= -0.40223E-08  pz= -0.17808E+00
mx=  0.51406E-14  my=  0.11257E-16  mz=  0.22066E-01 cmx=  0.97131E+00 cmy=  0.31337E-16 cmz=  0.99981E+00
mode   6   7 fr=  0.16637E+02 dp=  0.0500 px= -0.24809E-05  py=  0.74675E-08  pz=  0.96057E-05
mx=  0.67145E-11  my=  0.60833E-16  mz=  0.10066E-09 cmx=  0.97131E+00 cmy=  0.92170E-16 cmz=  0.99981E+00
mode  10   8 fr=  0.28141E+02 dp=  0.0500 px=  0.20487E+00  py=  0.46590E-08  pz=  0.13937E-07
mx=  0.28857E-01  my=  0.14924E-16  mz=  0.13356E-15 cmx=  0.10002E+01 cmy=  0.10709E-15 cmz=  0.99981E+00
mode   8   9 fr=  0.24287E+02 dp=  0.0500 px=  0.26154E-06  py= -0.36627E-08  pz= -0.11276E-05
mx=  0.74904E-13  my=  0.14691E-16  mz=  0.13924E-11 cmx=  0.10002E+01 cmy=  0.12179E-15 cmz=  0.99981E+00
mode   9  10 fr=  0.25536E+02 dp=  0.0500 px= -0.41967E-06  py=  0.91255E-09  pz= -0.15915E-05
mx=  0.14938E-12  my=  0.70629E-18  mz=  0.21483E-11 cmx=  0.10002E+01 cmy=  0.12249E-15 cmz=  0.99981E+00
mode  11  11 fr=  0.28213E+02 dp=  0.0500 px=  0.16277E-04  py= -0.65853E-08  pz=  0.47598E-07
mx=  0.29639E-09  my=  0.48512E-16  mz=  0.25345E-14 cmx=  0.10002E+01 cmy=  0.17100E-15 cmz=  0.99981E+00
mode  12  12 fr=  0.35392E+02 dp=  0.0500 px= -0.16387E-05  py= -0.17325E-08  pz= -0.10635E-06
mx=  0.23579E-11  my=  0.26354E-17  mz=  0.99312E-14 cmx=  0.10002E+01 cmy=  0.17364E-15 cmz=  0.99981E+00

no. of considered = 11
```

TABLE 14

Resonse of building 3 by R.S.T

Displacements of nodes

NODE = 1

spatial combination A (srss)

method	node	Ux	Uy	Uz	Rxx	Ryy	Rzz
SRSS	1	0.880242E-02	0.803183E-13	0.132736E-01	0.000000E+00	0.000000E+00	0.000000E+00
CQC	1	0.880216E-02	0.737319E-13	0.132722E-01	0.000000E+00	0.000000E+00	0.000000E+00
GROUPING	1	0.880242E-02	0.814953E-13	0.132736E-01	0.000000E+00	0.000000E+00	0.000000E+00
10 %	1	0.880242E-02	0.810576E-13	0.132736E-01	0.000000E+00	0.000000E+00	0.000000E+00
DOUBLE SUM	1	0.880451E-02	0.930286E-13	0.132763E-01	0.000000E+00	0.000000E+00	0.000000E+00

spatial combination B (R=R1+0.4R2+0.4R3)

method	node	Ux	Uy	Uz	Rxx	Ryy	Rzz
SRSS	1	0.880242E-02	0.321273E-13	0.530946E-02	0.000000E+00	0.000000E+00	0.000000E+00
CQC	1	0.880216E-02	0.294928E-13	0.530886E-02	0.000000E+00	0.000000E+00	0.000000E+00
GROUPING	1	0.880242E-02	0.325981E-13	0.530946E-02	0.000000E+00	0.000000E+00	0.000000E+00
10 %	1	0.880242E-02	0.324230E-13	0.530946E-02	0.000000E+00	0.000000E+00	0.000000E+00
DOUBLE SUM	1	0.880451E-02	0.372114E-13	0.531052E-02	0.000000E+00	0.000000E+00	0.000000E+00

spatial combination C (R=0.4R1+R2+0.4R3)

method	node	Ux	Uy	Uz	Rxx	Ryy	Rzz
SRSS	1	0.352097E-02	0.803183E-13	0.530946E-02	0.000000E+00	0.000000E+00	0.000000E+00
CQC	1	0.352087E-02	0.737319E-13	0.530886E-02	0.000000E+00	0.000000E+00	0.000000E+00
GROUPING	1	0.352097E-02	0.814953E-13	0.530946E-02	0.000000E+00	0.000000E+00	0.000000E+00
10 %	1	0.352097E-02	0.810576E-13	0.530946E-02	0.000000E+00	0.000000E+00	0.000000E+00
DOUBLE SUM	1	0.352181E-02	0.930286E-13	0.531052E-02	0.000000E+00	0.000000E+00	0.000000E+00

spatial combination D (R=0.4R1+0.4R2+R3)

method	node	Ux	Uy	Uz	Rxx	Ryy	Rzz
SRSS	1	0.352097E-02	0.321273E-13	0.132736E-01	0.000000E+00	0.000000E+00	0.000000E+00
CQC	1	0.352087E-02	0.294928E-13	0.132722E-01	0.000000E+00	0.000000E+00	0.000000E+00
GROUPING	1	0.352097E-02	0.325981E-13	0.132736E-01	0.000000E+00	0.000000E+00	0.000000E+00
10 %	1	0.352097E-02	0.324230E-13	0.132736E-01	0.000000E+00	0.000000E+00	0.000000E+00
DOUBLE SUM	1	0.352181E-02	0.372114E-13	0.132763E-01	0.000000E+00	0.000000E+00	0.000000E+00

NODE = 5

spatial combination A (srss)

method	node	Ux	Uy	Uz	Rxx	Ryy	Rzz
SRSS	5	0.642756E-02	0.705926E-13	0.100421E-01	0.000000E+00	0.000000E+00	0.000000E+00
CQC	5	0.642840E-02	0.640665E-13	0.100431E-01	0.000000E+00	0.000000E+00	0.000000E+00
GROUPING	5	0.642756E-02	0.712538E-13	0.100421E-01	0.000000E+00	0.000000E+00	0.000000E+00
10 %	5	0.642756E-02	0.709009E-13	0.100421E-01	0.000000E+00	0.000000E+00	0.000000E+00
DOUBLE SUM	5	0.642931E-02	0.812746E-13	0.100442E-01	0.000000E+00	0.000000E+00	0.000000E+00

spatial combination B (R=R1+0.4R2+0.4R3)

SRSS	5	0.642756E-02	0.282371E-13	0.401683E-02	0.000000E+00	0.000000E+00	0.000000E+00
CQC	5	0.642840E-02	0.256266E-13	0.401722E-02	0.000000E+00	0.000000E+00	0.000000E+00
GROUPING	5	0.642756E-02	0.285015E-13	0.401683E-02	0.000000E+00	0.000000E+00	0.000000E+00
10 %	5	0.642756E-02	0.283604E-13	0.401683E-02	0.000000E+00	0.000000E+00	0.000000E+00
DOUBLE SUM	5	0.642931E-02	0.325098E-13	0.401769E-02	0.000000E+00	0.000000E+00	0.000000E+00

spatial combination C (R=0.4R1+R2+0.4R3)

SRSS	5	0.257102E-02	0.705926E-13	0.401683E-02	0.000000E+00	0.000000E+00	0.000000E+00
CQC	5	0.257136E-02	0.640665E-13	0.401722E-02	0.000000E+00	0.000000E+00	0.000000E+00
GROUPING	5	0.257102E-02	0.712538E-13	0.401683E-02	0.000000E+00	0.000000E+00	0.000000E+00
10 %	5	0.257102E-02	0.709009E-13	0.401683E-02	0.000000E+00	0.000000E+00	0.000000E+00
DOUBLE SUM	5	0.257172E-02	0.812746E-13	0.401769E-02	0.000000E+00	0.000000E+00	0.000000E+00

spatial combination D (R=0.4R1+0.4R2+R3)

SRSS	5	0.257102E-02	0.282371E-13	0.100421E-01	0.000000E+00	0.000000E+00	0.000000E+00
CQC	5	0.257136E-02	0.256266E-13	0.100431E-01	0.000000E+00	0.000000E+00	0.000000E+00
GROUPING	5	0.257102E-02	0.285015E-13	0.100421E-01	0.000000E+00	0.000000E+00	0.000000E+00
10 %	5	0.257102E-02	0.283604E-13	0.100421E-01	0.000000E+00	0.000000E+00	0.000000E+00
DOUBLE SUM	5	0.257172E-02	0.325098E-13	0.100442E-01	0.000000E+00	0.000000E+00	0.000000E+00

NODE = 6

spatial combination A (srss)

method	node	Ux	Uy	Uz	Rxx	Ryy	Rzz

SRSS	6	0.642756E-02	0.701151E-13	0.100411E-01	0.000000E+00	0.000000E+00	0.000000E+00
CQC	6	0.642840E-02	0.722020E-13	0.100422E-01	0.000000E+00	0.000000E+00	0.000000E+00
GROUPING	6	0.642756E-02	0.707808E-13	0.100411E-01	0.000000E+00	0.000000E+00	0.000000E+00
10 %	6	0.642756E-02	0.704255E-13	0.100411E-01	0.000000E+00	0.000000E+00	0.000000E+00
DOUBLE SUM	6	0.642931E-02	0.806343E-13	0.100433E-01	0.000000E+00	0.000000E+00	0.000000E+00

spatial combination B (R=R1+0.4R2+0.4R3)

SRSS	6	0.642756E-02	0.280461E-13	0.401645E-02	0.000000E+00	0.000000E+00	0.000000E+00
CQC	6	0.642840E-02	0.288808E-13	0.401686E-02	0.000000E+00	0.000000E+00	0.000000E+00
GROUPING	6	0.642756E-02	0.283123E-13	0.401645E-02	0.000000E+00	0.000000E+00	0.000000E+00
10 %	6	0.642756E-02	0.281702E-13	0.401645E-02	0.000000E+00	0.000000E+00	0.000000E+00
DOUBLE SUM	6	0.642931E-02	0.322537E-13	0.401731E-02	0.000000E+00	0.000000E+00	0.000000E+00

spatial combination C (R=0.4R1+R2+0.4R3)

SRSS	6	0.257102E-02	0.701151E-13	0.401645E-02	0.000000E+00	0.000000E+00	0.000000E+00
CQC	6	0.257136E-02	0.722020E-13	0.401686E-02	0.000000E+00	0.000000E+00	0.000000E+00
GROUPING	6	0.257102E-02	0.707808E-13	0.401645E-02	0.000000E+00	0.000000E+00	0.000000E+00
10 %	6	0.257102E-02	0.704255E-13	0.401645E-02	0.000000E+00	0.000000E+00	0.000000E+00
DOUBLE SUM	6	0.257172E-02	0.806343E-13	0.401731E-02	0.000000E+00	0.000000E+00	0.000000E+00

spatial combination D (R=0.4R1+0.4R2+R3)

SRSS	6	0.257102E-02	0.280461E-13	0.100411E-01	0.000000E+00	0.000000E+00	0.000000E+00
CQC	6	0.257136E-02	0.288808E-13	0.100422E-01	0.000000E+00	0.000000E+00	0.000000E+00
GROUPING	6	0.257102E-02	0.283123E-13	0.100411E-01	0.000000E+00	0.000000E+00	0.000000E+00
10 %	6	0.257102E-02	0.281702E-13	0.100411E-01	0.000000E+00	0.000000E+00	0.000000E+00
DOUBLE SUM	6	0.257172E-02	0.322537E-13	0.100433E-01	0.000000E+00	0.000000E+00	0.000000E+00

NODE = 9

spatial combination A (srss)

method	node	Ux	Uy	Uz	Rxx	Ryy	Rzz
SRSS	9	0.280944E-02	0.440178E-13	0.474342E-02	0.000000E+00	0.000000E+00	0.000000E+00
CQC	9	0.281045E-02	0.390502E-13	0.474539E-02	0.000000E+00	0.000000E+00	0.000000E+00

10 %	9	0.280944E-02	0.440775E-13	0.474342E-02	0.000000E+00	0.000000E+00	0.000000E+00
DOUBLE SUM	9	0.281127E-02	0.504065E-13	0.474679E-02	0.000000E+00	0.000000E+00	0.000000E+00

spatial combination B (R=R1+0.4R2+0.4R3)

SRSS	9	0.280944E-02	0.176071E-13	0.189737E-02	0.000000E+00	0.000000E+00	0.000000E+00
CQC	9	0.281045E-02	0.156201E-13	0.189816E-02	0.000000E+00	0.000000E+00	0.000000E+00
GROUPING	9	0.280944E-02	0.176947E-13	0.189737E-02	0.000000E+00	0.000000E+00	0.000000E+00
10 %	9	0.280944E-02	0.176310E-13	0.189737E-02	0.000000E+00	0.000000E+00	0.000000E+00
DOUBLE SUM	9	0.281127E-02	0.201626E-13	0.189872E-02	0.000000E+00	0.000000E+00	0.000000E+00

spatial combination C (R=0.4R1+R2+0.4R3)

SRSS	9	0.112378E-02	0.440178E-13	0.189737E-02	0.000000E+00	0.000000E+00	0.000000E+00
CQC	9	0.112418E-02	0.390502E-13	0.189816E-02	0.000000E+00	0.000000E+00	0.000000E+00
GROUPING	9	0.112378E-02	0.442368E-13	0.189737E-02	0.000000E+00	0.000000E+00	0.000000E+00
10 %	9	0.112378E-02	0.440775E-13	0.189737E-02	0.000000E+00	0.000000E+00	0.000000E+00
DOUBLE SUM	9	0.112451E-02	0.504065E-13	0.189872E-02	0.000000E+00	0.000000E+00	0.000000E+00

spatial combination D (R=0.4R1+0.4R2+R3)

SRSS	9	0.112378E-02	0.176071E-13	0.474342E-02	0.000000E+00	0.000000E+00	0.000000E+00
CQC	9	0.112418E-02	0.156201E-13	0.474539E-02	0.000000E+00	0.000000E+00	0.000000E+00
GROUPING	9	0.112378E-02	0.176947E-13	0.474342E-02	0.000000E+00	0.000000E+00	0.000000E+00
10 %	9	0.112378E-02	0.176310E-13	0.474342E-02	0.000000E+00	0.000000E+00	0.000000E+00
DOUBLE SUM	9	0.112451E-02	0.201626E-13	0.474679E-02	0.000000E+00	0.000000E+00	0.000000E+00

Forces by R.S.T
ELEMENT = 1
spatial combination A (srss)

method	node	Fx	Fy	Fz	Mxx	Myy	Mzz
SRSS	1	0.234853E-09	0.126082E-05	0.102098E+02	0.000000E+00	0.204191E+02	0.252157E-05
	2	0.234853E-09	0.126082E-05	0.102098E+02	0.000000E+00	0.204191E+02	0.252157E-05
CQC	1	0.234659E-09	0.121486E-05	0.989318E+01	0.000000E+00	0.197859E+02	0.242966E-05
	2	0.234659E-09	0.121486E-05	0.989318E+01	0.000000E+00	0.197859E+02	0.242966E-05
GROUPING	1	0.234853E-09	0.128031E-05	0.102098E+02	0.000000E+00	0.204191E+02	0.256057E-05
	2	0.234853E-09	0.128031E-05	0.102098E+02	0.000000E+00	0.204191E+02	0.256057E-05

10 %	1	0.234853E-09	0.127137E-05	0.102098E+02	0.000000E+00	0.204191E+02	0.254268E-05
	2	0.234853E-09	0.127137E-05	0.102098E+02	0.000000E+00	0.204191E+02	0.254268E-05
DOUBLE SUM	1	0.235072E-09	0.136611E-05	0.105676E+02	0.000000E+00	0.211347E+02	0.273216E-05
	2	0.235072E-09	0.136611E-05	0.105676E+02	0.000000E+00	0.211347E+02	0.273216E-05

spatial combination B (R=R1+0.4R2+0.4R3)

SRSS	1	0.234853E-09	0.504326E-06	0.408391E+01	0.000000E+00	0.816763E+01	0.100863E-05
	2	0.234853E-09	0.504326E-06	0.408391E+01	0.000000E+00	0.816763E+01	0.100863E-05
CQC	1	0.234659E-09	0.485944E-06	0.395727E+01	0.000000E+00	0.791437E+01	0.971866E-06
	2	0.234659E-09	0.485944E-06	0.395727E+01	0.000000E+00	0.791437E+01	0.971866E-06
GROUPING	1	0.234853E-09	0.512125E-06	0.408391E+01	0.000000E+00	0.816763E+01	0.102423E-05
	2	0.234853E-09	0.512125E-06	0.408391E+01	0.000000E+00	0.816763E+01	0.102423E-05
10 %	1	0.234853E-09	0.508548E-06	0.408391E+01	0.000000E+00	0.816763E+01	0.101707E-05
	2	0.234853E-09	0.508548E-06	0.408391E+01	0.000000E+00	0.816763E+01	0.101707E-05
DOUBLE SUM	1	0.235072E-09	0.546445E-06	0.422702E+01	0.000000E+00	0.845386E+01	0.109287E-05
	2	0.235072E-09	0.546445E-06	0.422702E+01	0.000000E+00	0.845386E+01	0.109287E-05

spatial combination C (R=0.4R1+R2+0.4R3)

SRSS	1	0.939410E-10	0.126082E-05	0.408391E+01	0.000000E+00	0.816763E+01	0.252157E-05
	2	0.939410E-10	0.126082E-05	0.408391E+01	0.000000E+00	0.816763E+01	0.252157E-05
CQC	1	0.938634E-10	0.121486E-05	0.395727E+01	0.000000E+00	0.791437E+01	0.242966E-05
	2	0.938634E-10	0.121486E-05	0.395727E+01	0.000000E+00	0.791437E+01	0.242966E-05
GROUPING	1	0.939410E-10	0.128031E-05	0.408391E+01	0.000000E+00	0.816763E+01	0.256057E-05
	2	0.939410E-10	0.128031E-05	0.408391E+01	0.000000E+00	0.816763E+01	0.256057E-05
10 %	1	0.939410E-10	0.127137E-05	0.408391E+01	0.000000E+00	0.816763E+01	0.254268E-05
	2	0.939410E-10	0.127137E-05	0.408391E+01	0.000000E+00	0.816763E+01	0.254268E-05
DOUBLE SUM	1	0.940288E-10	0.136611E-05	0.422702E+01	0.000000E+00	0.845386E+01	0.273216E-05
	2	0.940288E-10	0.136611E-05	0.422702E+01	0.000000E+00	0.845386E+01	0.273216E-05

spatial combination D (R=0.4R1+0.4R2+R3)

SRSS	1	0.939410E-10	0.504326E-06	0.102098E+02	0.000000E+00	0.204191E+02	0.100863E-05
	2	0.939410E-10	0.504326E-06	0.102098E+02	0.000000E+00	0.204191E+02	0.100863E-05
CQC	1	0.938634E-10	0.485944E-06	0.989318E+01	0.000000E+00	0.197859E+02	0.971866E-06
	2	0.938634E-10	0.485944E-06	0.989318E+01	0.000000E+00	0.197859E+02	0.971866E-06
GROUPING	1	0.939410E-10	0.512125E-06	0.102098E+02	0.000000E+00	0.204191E+02	0.102423E-05
	2	0.939410E-10	0.512125E-06	0.102098E+02	0.000000E+00	0.204191E+02	0.102423E-05
10 %	1	0.939410E-10	0.508548E-06	0.102098E+02	0.000000E+00	0.204191E+02	0.101707E-05
	2	0.939410E-10	0.508548E-06	0.102098E+02	0.000000E+00	0.204191E+02	0.101707E-05
DOUBLE SUM	1	0.940288E-10	0.546445E-06	0.105676E+02	0.000000E+00	0.211347E+02	0.109287E-05
	2	0.940288E-10	0.546445E-06	0.105676E+02	0.000000E+00	0.211347E+02	0.109287E-05

ELEMENT = 9

method	node	Fx	Fy	Fz	Mxx	Myy	Mzz
SRSS	5	0.391973E-09	0.111250E-05	0.879790E+01	0.000000E+00	0.175954E+02	0.222494E-05
	6	0.391973E-09	0.111250E-05	0.879790E+01	0.000000E+00	0.175954E+02	0.222494E-05
CQC	5	0.392841E-09	0.106848E-05	0.855102E+01	0.000000E+00	0.171017E+02	0.213691E-05
	6	0.392841E-09	0.106848E-05	0.855102E+01	0.000000E+00	0.171017E+02	0.213691E-05
GROUPING	5	0.391973E-09	0.112423E-05	0.879790E+01	0.000000E+00	0.175954E+02	0.224841E-05
	6	0.391973E-09	0.112423E-05	0.879790E+01	0.000000E+00	0.175954E+02	0.224841E-05
10 %	5	0.391973E-09	0.111705E-05	0.879790E+01	0.000000E+00	0.175954E+02	0.223405E-05
	6	0.391973E-09	0.111705E-05	0.879790E+01	0.000000E+00	0.175954E+02	0.223405E-05
DOUBLE SUM	5	0.392955E-09	0.119641E-05	0.907718E+01	0.000000E+00	0.181540E+02	0.239276E-05
	6	0.392955E-09	0.119641E-05	0.907718E+01	0.000000E+00	0.181540E+02	0.239276E-05
spatial combination B (R=R1+0.4R2+0.4R3)							
SRSS	5	0.391973E-09	0.444999E-06	0.351916E+01	0.000000E+00	0.703817E+01	0.889977E-06
	6	0.391973E-09	0.444999E-06	0.351916E+01	0.000000E+00	0.703817E+01	0.889977E-06
CQC	5	0.392841E-09	0.427392E-06	0.342041E+01	0.000000E+00	0.684066E+01	0.854765E-06
	6	0.392841E-09	0.427392E-06	0.342041E+01	0.000000E+00	0.684066E+01	0.854765E-06
GROUPING	5	0.391973E-09	0.449691E-06	0.351916E+01	0.000000E+00	0.703817E+01	0.899362E-06
	6	0.391973E-09	0.449691E-06	0.351916E+01	0.000000E+00	0.703817E+01	0.899362E-06
10 %	5	0.391973E-09	0.446819E-06	0.351916E+01	0.000000E+00	0.703817E+01	0.893618E-06
	6	0.391973E-09	0.446819E-06	0.351916E+01	0.000000E+00	0.703817E+01	0.893618E-06
DOUBLE SUM	5	0.392955E-09	0.478563E-06	0.363087E+01	0.000000E+00	0.726158E+01	0.957104E-06
	6	0.392955E-09	0.478563E-06	0.363087E+01	0.000000E+00	0.726158E+01	0.957104E-06
spatial combination C (R=0.4R1+R2+0.4R3)							
SRSS	5	0.156789E-09	0.111250E-05	0.351916E+01	0.000000E+00	0.703817E+01	0.222494E-05
	6	0.156789E-09	0.111250E-05	0.351916E+01	0.000000E+00	0.703817E+01	0.222494E-05
CQC	5	0.157136E-09	0.106848E-05	0.342041E+01	0.000000E+00	0.684066E+01	0.213691E-05
	6	0.157136E-09	0.106848E-05	0.342041E+01	0.000000E+00	0.684066E+01	0.213691E-05
GROUPING	5	0.156789E-09	0.112423E-05	0.351916E+01	0.000000E+00	0.703817E+01	0.224841E-05
	6	0.156789E-09	0.112423E-05	0.351916E+01	0.000000E+00	0.703817E+01	0.224841E-05
10 %	5	0.156789E-09	0.111705E-05	0.351916E+01	0.000000E+00	0.703817E+01	0.223405E-05
	6	0.156789E-09	0.111705E-05	0.351916E+01	0.000000E+00	0.703817E+01	0.223405E-05
DOUBLE SUM	5	0.157182E-09	0.119641E-05	0.363087E+01	0.000000E+00	0.726158E+01	0.239276E-05
	6	0.157182E-09	0.119641E-05	0.363087E+01	0.000000E+00	0.726158E+01	0.239276E-05
spatial combination D (R=0.4R1+0.4R2+R3)							
SRSS	5	0.156789E-09	0.444999E-06	0.879790E+01	0.000000E+00	0.175954E+02	0.889977E-06
	6	0.156789E-09	0.444999E-06	0.879790E+01	0.000000E+00	0.175954E+02	0.889977E-06
CQC	5	0.157136E-09	0.427392E-06	0.855102E+01	0.000000E+00	0.171017E+02	0.854765E-06
	6	0.157136E-09	0.427392E-06	0.855102E+01	0.000000E+00	0.171017E+02	0.854765E-06

	6	0.156789E-09	0.449691E-06	0.879790E+01	0.000000E+00	0.175954E+02	0.899362E-06
10 %	5	0.156789E-09	0.446819E-06	0.879790E+01	0.000000E+00	0.175954E+02	0.893618E-06
	6	0.156789E-09	0.446819E-06	0.879790E+01	0.000000E+00	0.175954E+02	0.893618E-06
DOUBLE SUM	5	0.157182E-09	0.478563E-06	0.907718E+01	0.000000E+00	0.181540E+02	0.957104E-06
	6	0.157182E-09	0.478563E-06	0.907718E+01	0.000000E+00	0.181540E+02	0.957104E-06

ELEMENT = 10

spatial combination A (srss)

method	node	Fx	Fy	Fz	Mxx	Myy	Mzz
SRSS	6	0.940841E+01	0.630506E-06	0.794408E-10	0.126098E-05	0.188164E+02	0.000000E+00
	7	0.940841E+01	0.630506E-06	0.794408E-10	0.126098E-05	0.188164E+02	0.000000E+00
CQC	6	0.111248E+02	0.623751E-06	0.794478E-10	0.124747E-05	0.222492E+02	0.000000E+00
	7	0.111248E+02	0.623751E-06	0.794478E-10	0.124747E-05	0.222492E+02	0.000000E+00
GROUPING	6	0.940841E+01	0.646204E-06	0.794408E-10	0.129238E-05	0.188164E+02	0.000000E+00
	7	0.940841E+01	0.646204E-06	0.794408E-10	0.129238E-05	0.188164E+02	0.000000E+00
10 %	6	0.940841E+01	0.633630E-06	0.794408E-10	0.126723E-05	0.188164E+02	0.000000E+00
	7	0.940841E+01	0.633630E-06	0.794408E-10	0.126723E-05	0.188164E+02	0.000000E+00
DOUBLE SUM	6	0.112480E+02	0.660032E-06	0.794489E-10	0.132004E-05	0.224954E+02	0.000000E+00
	7	0.112480E+02	0.660032E-06	0.794489E-10	0.132004E-05	0.224954E+02	0.000000E+00

spatial combination B (R=R1+0.4R2+0.4R3)

SRSS	6	0.940841E+01	0.252202E-06	0.317763E-10	0.504394E-06	0.188164E+02	0.000000E+00
	7	0.940841E+01	0.252202E-06	0.317763E-10	0.504394E-06	0.188164E+02	0.000000E+00
CQC	6	0.111248E+02	0.249500E-06	0.317791E-10	0.498990E-06	0.222492E+02	0.000000E+00
	7	0.111248E+02	0.249500E-06	0.317791E-10	0.498990E-06	0.222492E+02	0.000000E+00
GROUPING	6	0.940841E+01	0.258482E-06	0.317763E-10	0.516952E-06	0.188164E+02	0.000000E+00
	7	0.940841E+01	0.258482E-06	0.317763E-10	0.516952E-06	0.188164E+02	0.000000E+00
10 %	6	0.940841E+01	0.253452E-06	0.317763E-10	0.506893E-06	0.188164E+02	0.000000E+00
	7	0.940841E+01	0.253452E-06	0.317763E-10	0.506893E-06	0.188164E+02	0.000000E+00
DOUBLE SUM	6	0.112480E+02	0.264013E-06	0.317796E-10	0.528014E-06	0.224954E+02	0.000000E+00
	7	0.112480E+02	0.264013E-06	0.317796E-10	0.528014E-06	0.224954E+02	0.000000E+00

spatial combination C (R=0.4R1+R2+0.4R3)

SRSS	6	0.376336E+01	0.630506E-06	0.317763E-10	0.126098E-05	0.752656E+01	0.000000E+00
	7	0.376336E+01	0.630506E-06	0.317763E-10	0.126098E-05	0.752656E+01	0.000000E+00
CQC	6	0.444993E+01	0.623751E-06	0.317791E-10	0.124747E-05	0.889966E+01	0.000000E+00
	7	0.444993E+01	0.623751E-06	0.317791E-10	0.124747E-05	0.889966E+01	0.000000E+00
GROUPING	6	0.376337E+01	0.646204E-06	0.317763E-10	0.129238E-05	0.752656E+01	0.000000E+00
	7	0.376337E+01	0.646204E-06	0.317763E-10	0.129238E-05	0.752656E+01	0.000000E+00
10 %	6	0.376337E+01	0.633630E-06	0.317763E-10	0.126723E-05	0.752656E+01	0.000000E+00
	7	0.376337E+01	0.633630E-06	0.317763E-10	0.126723E-05	0.752656E+01	0.000000E+00
DOUBLE SUM	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		

spatial combination D (R=0.4R1+0.4R2+R3)

SRSS	6	0.376336E+01	0.252202E-06	0.794408E-10	0.504394E-06	0.752656E+01	0.000000E+00
	7	0.376336E+01	0.252202E-06	0.794408E-10	0.504394E-06	0.752656E+01	0.000000E+00
CQC	6	0.444993E+01	0.249500E-06	0.794478E-10	0.498990E-06	0.889966E+01	0.000000E+00
	7	0.444993E+01	0.249500E-06	0.794478E-10	0.498990E-06	0.889966E+01	0.000000E+00
GROUPING	6	0.376337E+01	0.258482E-06	0.794408E-10	0.516952E-06	0.752656E+01	0.000000E+00
	7	0.376337E+01	0.258482E-06	0.794408E-10	0.516952E-06	0.752656E+01	0.000000E+00
10 %	6	0.376337E+01	0.253452E-06	0.794408E-10	0.506893E-06	0.752656E+01	0.000000E+00
	7	0.376337E+01	0.253452E-06	0.794408E-10	0.506893E-06	0.752656E+01	0.000000E+00
DOUBLE SUM	6	0.449918E+01	0.264013E-06	0.794489E-10	0.528014E-06	0.899816E+01	0.000000E+00
	7	0.449918E+01	0.264013E-06	0.794489E-10	0.528014E-06	0.899816E+01	0.000000E+00

ELEMENT = 23

spatial combination A (srss)

method	node	Fx	Fy	Fz	Mxx	Myy	Mzz
SRSS	15	0.251631E+05	0.440195E-04	0.212374E+05	0.424747E+05	0.000000E+00	0.503250E+05
	11	0.251631E+05	0.440195E-04	0.212374E+05	0.424747E+05	0.000000E+00	0.503250E+05
CQC	15	0.251732E+05	0.420470E-04	0.212463E+05	0.424925E+05	0.000000E+00	0.503453E+05
	11	0.251732E+05	0.420470E-04	0.212463E+05	0.424925E+05	0.000000E+00	0.503453E+05
GROUPING	15	0.251631E+05	0.442384E-04	0.212374E+05	0.424747E+05	0.000000E+00	0.503250E+05
	11	0.251631E+05	0.442384E-04	0.212374E+05	0.424747E+05	0.000000E+00	0.503250E+05
10 %	15	0.251631E+05	0.440792E-04	0.212374E+05	0.424747E+05	0.000000E+00	0.503250E+05
	11	0.251631E+05	0.440792E-04	0.212374E+05	0.424747E+05	0.000000E+00	0.503250E+05
DOUBLE SUM	15	0.251794E+05	0.504091E-04	0.212525E+05	0.425049E+05	0.000000E+00	0.503578E+05
	11	0.251794E+05	0.504091E-04	0.212525E+05	0.425049E+05	0.000000E+00	0.503578E+05

spatial combination B (R=R1+0.4R2+0.4R3)

SRSS	15	0.251631E+05	0.176078E-04	0.849494E+04	0.169899E+05	0.000000E+00	0.503250E+05
	11	0.251631E+05	0.176078E-04	0.849494E+04	0.169899E+05	0.000000E+00	0.503250E+05
CQC	15	0.251732E+05	0.168188E-04	0.849850E+04	0.169970E+05	0.000000E+00	0.503453E+05
	11	0.251732E+05	0.168188E-04	0.849850E+04	0.169970E+05	0.000000E+00	0.503453E+05
GROUPING	15	0.251631E+05	0.176954E-04	0.849494E+04	0.169899E+05	0.000000E+00	0.503250E+05
	11	0.251631E+05	0.176954E-04	0.849494E+04	0.169899E+05	0.000000E+00	0.503250E+05
10 %	15	0.251631E+05	0.176317E-04	0.849494E+04	0.169899E+05	0.000000E+00	0.503250E+05
	11	0.251631E+05	0.176317E-04	0.849494E+04	0.169899E+05	0.000000E+00	0.503250E+05
DOUBLE SUM	15	0.251794E+05	0.201636E-04	0.850098E+04	0.170020E+05	0.000000E+00	0.503578E+05
	11	0.251794E+05	0.201636E-04	0.850098E+04	0.170020E+05	0.000000E+00	0.503578E+05

spatial combination C (R=0.4R1+R2+0.4R3)

SRSS	15	0.100652E+05	0.440195E-04	0.849494E+04	0.169899E+05	0.000000E+00	0.201300E+05

CQC	15	0.100693E+05	0.420470E-04	0.849850E+04	0.169970E+05	0.000000E+00	0.201381E+05
	11	0.100693E+05	0.420470E-04	0.849850E+04	0.169970E+05	0.000000E+00	0.201381E+05
GROUPING	15	0.100652E+05	0.442384E-04	0.849494E+04	0.169899E+05	0.000000E+00	0.201300E+05
	11	0.100652E+05	0.442384E-04	0.849494E+04	0.169899E+05	0.000000E+00	0.201300E+05
10 %	15	0.100652E+05	0.440792E-04	0.849494E+04	0.169899E+05	0.000000E+00	0.201300E+05
	11	0.100652E+05	0.440792E-04	0.849494E+04	0.169899E+05	0.000000E+00	0.201300E+05
DOUBLE SUM	15	0.100718E+05	0.504091E-04	0.850098E+04	0.170020E+05	0.000000E+00	0.201431E+05
	11	0.100718E+05	0.504091E-04	0.850098E+04	0.170020E+05	0.000000E+00	0.201431E+05

spatial combination D (R=0.4R1+0.4R2+R3)

SRSS	15	0.100652E+05	0.176078E-04	0.212374E+05	0.424747E+05	0.000000E+00	0.201300E+05
	11	0.100652E+05	0.176078E-04	0.212374E+05	0.424747E+05	0.000000E+00	0.201300E+05
CQC	15	0.100693E+05	0.168188E-04	0.212463E+05	0.424925E+05	0.000000E+00	0.201381E+05
	11	0.100693E+05	0.168188E-04	0.212463E+05	0.424925E+05	0.000000E+00	0.201381E+05
GROUPING	15	0.100652E+05	0.176954E-04	0.212374E+05	0.424747E+05	0.000000E+00	0.201300E+05
	11	0.100652E+05	0.176954E-04	0.212374E+05	0.424747E+05	0.000000E+00	0.201300E+05
10 %	15	0.100652E+05	0.176317E-04	0.212374E+05	0.424747E+05	0.000000E+00	0.201300E+05
	11	0.100652E+05	0.176317E-04	0.212374E+05	0.424747E+05	0.000000E+00	0.201300E+05
DOUBLE SUM	15	0.100718E+05	0.201636E-04	0.212525E+05	0.425049E+05	0.000000E+00	0.201431E+05
	11	0.100718E+05	0.201636E-04	0.212525E+05	0.425049E+05	0.000000E+00	0.201431E+05

TABLE 15

Response of building 3 by T.H.A

Nodal displacements

method	node	Ux	Uy	Uz			
SRSS	1	0.820695E-02	0.681526E-13	0.129373E-01	0.000000E+00	0.000000E+00	0.000000E+00
SRSS	5	0.609927E-02	0.600052E-13	0.997764E-02	0.000000E+00	0.000000E+00	0.000000E+00
SRSS	6	0.609927E-02	0.827643E-13	0.997680E-02	0.000000E+00	0.000000E+00	0.000000E+00
SRSS	9	0.275028E-02	0.370386E-13	0.482618E-02	0.000000E+00	0.000000E+00	0.000000E+00

Forces by T.H.A.

method	Element						
SRSS	Element 1						
	1	0.186265E-08	0.978122E-06	0.881599E+01	0.000000E+00	0.176316E+02	0.195620E-05
	2	0.186265E-08	0.978122E-06	0.881599E+01	0.000000E+00	0.176316E+02	0.195620E-05
SRSS	Element 9						
	5	0.931323E-09	0.874884E-06	0.763726E+01	0.000000E+00	0.152742E+02	0.174973E-05
	6	0.931323E-09	0.874884E-06	0.763726E+01	0.000000E+00	0.152742E+02	0.174973E-05
SRSS	Element 10						
	6	0.121407E+02	0.780290E-06	0.931323E-09	0.156055E-05	0.242809E+02	0.000000E+00
	7	0.121407E+02	0.780290E-06	0.931323E-09	0.156055E-05	0.242809E+02	0.000000E+00
SRSS	Element 23						
	15	0.246347E+05	0.421761E-04	0.216081E+05	0.432162E+05	0.000000E+00	0.492682E+05
	11	0.246347E+05	0.421761E-04	0.216081E+05	0.432162E+05	0.000000E+00	0.492682E+05

TABLE 16

Errors in response by R.S.T. for Building 3

Errors in displacement

SPATIAL COMB 1

method	node	Ux	Uy	Uz			
SRSS	1	0.7256E-01	0.1785E+00	0.2600E-01	0.0000E+00	0.0000E+00	0.0000E+00
CQC	1	0.7253E-01	0.8187E-01	0.2589E-01	0.0000E+00	0.0000E+00	0.0000E+00
GROUPING	1	0.7256E-01	0.1958E+00	0.2600E-01	0.0000E+00	0.0000E+00	0.0000E+00
10 %	1	0.7256E-01	0.1894E+00	0.2600E-01	0.0000E+00	0.0000E+00	0.0000E+00
DOUBLE SUM	1	0.7281E-01	0.3650E+00	0.2620E-01	0.0000E+00	0.0000E+00	0.0000E+00
SPATIAL COMB 2							
SRSS	1	0.7256E-01	-0.5286E+00	-0.5896E+00	0.0000E+00	0.0000E+00	0.0000E+00
CQC	1	0.7253E-01	-0.5673E+00	-0.5897E+00	0.0000E+00	0.0000E+00	0.0000E+00
GROUPING	1	0.7256E-01	-0.5217E+00	-0.5896E+00	0.0000E+00	0.0000E+00	0.0000E+00
10 %	1	0.7256E-01	-0.5243E+00	-0.5896E+00	0.0000E+00	0.0000E+00	0.0000E+00
DOUBLE SUM	1	0.7281E-01	-0.4540E+00	-0.5895E+00	0.0000E+00	0.0000E+00	0.0000E+00
SPATIAL COMB 3							
SRSS	1	-0.5710E+00	0.1785E+00	-0.5896E+00	0.0000E+00	0.0000E+00	0.0000E+00
CQC	1	-0.5710E+00	0.8187E-01	-0.5897E+00	0.0000E+00	0.0000E+00	0.0000E+00
GROUPING	1	-0.5710E+00	0.1958E+00	-0.5896E+00	0.0000E+00	0.0000E+00	0.0000E+00
10 %	1	-0.5710E+00	0.1894E+00	-0.5896E+00	0.0000E+00	0.0000E+00	0.0000E+00
DOUBLE SUM	1	-0.5709E+00	0.3650E+00	-0.5895E+00	0.0000E+00	0.0000E+00	0.0000E+00
SPATIAL COMB 4							
SRSS	1	-0.5710E+00	-0.5286E+00	0.2600E-01	0.0000E+00	0.0000E+00	0.0000E+00
CQC	1	-0.5710E+00	-0.5673E+00	0.2589E-01	0.0000E+00	0.0000E+00	0.0000E+00
GROUPING	1	-0.5710E+00	-0.5217E+00	0.2600E-01	0.0000E+00	0.0000E+00	0.0000E+00
10 %	1	-0.5710E+00	-0.5243E+00	0.2600E-01	0.0000E+00	0.0000E+00	0.0000E+00
DOUBLE SUM	1	-0.5709E+00	-0.4540E+00	0.2620E-01	0.0000E+00	0.0000E+00	0.0000E+00
SPATIAL COMB 1							
SRSS	5	0.5382E-01	0.1764E+00	0.6461E-02	0.0000E+00	0.0000E+00	0.0000E+00
CQC	5	0.5396E-01	0.6768E-01	0.6561E-02	0.0000E+00	0.0000E+00	0.0000E+00
GROUPING	5	0.5382E-01	0.1875E+00	0.6461E-02	0.0000E+00	0.0000E+00	0.0000E+00
10 %	5	0.5382E-01	0.1816E+00	0.6461E-02	0.0000E+00	0.0000E+00	0.0000E+00
DOUBLE SUM	5	0.5411E-01	0.3545E+00	0.6471E-02	0.0000E+00	0.0000E+00	0.0000E+00

SPATIAL COMB 2

SRSS	5	0.5382E-01	-0.5294E+00	-0.5974E+00	0.0000E+00	0.0000E+00	0.0000E+00
CQC	5	0.5396E-01	-0.5729E+00	-0.5974E+00	0.0000E+00	0.0000E+00	0.0000E+00
GROUPING	5	0.5382E-01	-0.5250E+00	-0.5974E+00	0.0000E+00	0.0000E+00	0.0000E+00
10 %	5	0.5382E-01	-0.5274E+00	-0.5974E+00	0.0000E+00	0.0000E+00	0.0000E+00
DOUBLE SUM	5	0.5411E-01	-0.4582E+00	-0.5973E+00	0.0000E+00	0.0000E+00	0.0000E+00

SPATIAL COMB 3

SRSS	5	-0.5785E+00	0.1764E+00	-0.5974E+00	0.0000E+00	0.0000E+00	0.0000E+00
CQC	5	-0.5784E+00	0.6768E-01	-0.5974E+00	0.0000E+00	0.0000E+00	0.0000E+00
GROUPING	5	-0.5785E+00	0.1875E+00	-0.5974E+00	0.0000E+00	0.0000E+00	0.0000E+00
10 %	5	-0.5785E+00	0.1816E+00	-0.5974E+00	0.0000E+00	0.0000E+00	0.0000E+00
DOUBLE SUM	5	-0.5784E+00	0.3545E+00	-0.5973E+00	0.0000E+00	0.0000E+00	0.0000E+00

SPATIAL COMB 4

SRSS	5	-0.5785E+00	-0.5294E+00	0.6461E-02	0.0000E+00	0.0000E+00	0.0000E+00
CQC	5	-0.5784E+00	-0.5729E+00	0.6561E-02	0.0000E+00	0.0000E+00	0.0000E+00
GROUPING	5	-0.5785E+00	-0.5250E+00	0.6461E-02	0.0000E+00	0.0000E+00	0.0000E+00
10 %	5	-0.5785E+00	-0.5274E+00	0.6461E-02	0.0000E+00	0.0000E+00	0.0000E+00
DOUBLE SUM	5	-0.5784E+00	-0.4582E+00	0.6671E-02	0.0000E+00	0.0000E+00	0.0000E+00

SPATIAL COMB 1

SRSS	6	0.5382E-01	-0.1528E+00	0.6445E-02	0.0000E+00	0.0000E+00	0.0000E+00
CQC	6	0.5396E-01	-0.1276E+00	0.6555E-02	0.0000E+00	0.0000E+00	0.0000E+00
GROUPING	6	0.5382E-01	-0.1448E+00	0.6445E-02	0.0000E+00	0.0000E+00	0.0000E+00
10 %	6	0.5382E-01	-0.1491E+00	0.6445E-02	0.0000E+00	0.0000E+00	0.0000E+00
DOUBLE SUM	6	0.5411E-01	-0.2574E-01	0.6666E-02	0.0000E+00	0.0000E+00	0.0000E+00

SPATIAL COMB 2

SRSS	6	0.5382E-01	-0.6611E+00	-0.5974E+00	0.0000E+00	0.0000E+00	0.0000E+00
CQC	6	0.5396E-01	-0.6511E+00	-0.5974E+00	0.0000E+00	0.0000E+00	0.0000E+00
GROUPING	6	0.5382E-01	-0.6579E+00	-0.5974E+00	0.0000E+00	0.0000E+00	0.0000E+00
10 %	6	0.5382E-01	-0.6596E+00	-0.5974E+00	0.0000E+00	0.0000E+00	0.0000E+00
DOUBLE SUM	6	0.5411E-01	-0.6103E+00	-0.5973E+00	0.0000E+00	0.0000E+00	0.0000E+00

SPATIAL COMB 3

SRSS	6	-0.5785E+00	-0.1528E+00	-0.5974E+00	0.0000E+00	0.0000E+00	0.0000E+00
CQC	6	-0.5784E+00	-0.1276E+00	-0.5974E+00	0.0000E+00	0.0000E+00	0.0000E+00
GROUPING	6	-0.5785E+00	-0.1448E+00	-0.5974E+00	0.0000E+00	0.0000E+00	0.0000E+00

DOUBLE SUM	6	-0.5784E+00	-0.2574E-01	-0.5973E+00	0.0000E+00	0.0000E+00	0.0000E+00

SPATIAL COMB 4

SRSS	6	-0.5785E+00	-0.6611E+00	0.6445E-02	0.0000E+00	0.0000E+00	0.0000E+00
CQC	6	-0.5784E+00	-0.6511E+00	0.6555E-02	0.0000E+00	0.0000E+00	0.0000E+00
GROUPING	6	-0.5785E+00	-0.6579E+00	0.6445E-02	0.0000E+00	0.0000E+00	0.0000E+00
10 %	6	-0.5785E+00	-0.6596E+00	0.6445E-02	0.0000E+00	0.0000E+00	0.0000E+00
DOUBLE SUM	6	-0.5784E+00	-0.6103E+00	0.6666E-02	0.0000E+00	0.0000E+00	0.0000E+00

SPATIAL COMB 1

SRSS	9	0.2151E-01	0.1884E+00	-0.1715E-01	0.0000E+00	0.0000E+00	0.0000E+00
CQC	9	0.2188E-01	0.5431E-01	-0.1674E-01	0.0000E+00	0.0000E+00	0.0000E+00
GROUPING	9	0.2151E-01	0.1943E+00	-0.1715E-01	0.0000E+00	0.0000E+00	0.0000E+00
10 %	9	0.2151E-01	0.1900E+00	-0.1715E-01	0.0000E+00	0.0000E+00	0.0000E+00
DOUBLE SUM	9	0.2218E-01	0.3609E+00	-0.1645E-01	0.0000E+00	0.0000E+00	0.0000E+00

SPATIAL COMB 2

SRSS	9	0.2151E-01	-0.5246E+00	-0.6069E+00	0.0000E+00	0.0000E+00	0.0000E+00
CQC	9	0.2188E-01	-0.5783E+00	-0.6067E+00	0.0000E+00	0.0000E+00	0.0000E+00
GROUPING	9	0.2151E-01	-0.5223E+00	-0.6069E+00	0.0000E+00	0.0000E+00	0.0000E+00
10 %	9	0.2151E-01	-0.5240E+00	-0.6069E+00	0.0000E+00	0.0000E+00	0.0000E+00
DOUBLE SUM	9	0.2218E-01	-0.4556E+00	-0.6066E+00	0.0000E+00	0.0000E+00	0.0000E+00

SPATIAL COMB 3

SRSS	9	-0.5914E+00	0.1884E+00	-0.6069E+00	0.0000E+00	0.0000E+00	0.0000E+00
CQC	9	-0.5913E+00	0.5431E-01	-0.6067E+00	0.0000E+00	0.0000E+00	0.0000E+00
GROUPING	9	-0.5914E+00	0.1943E+00	-0.6069E+00	0.0000E+00	0.0000E+00	0.0000E+00
10 %	9	-0.5914E+00	0.1900E+00	-0.6069E+00	0.0000E+00	0.0000E+00	0.0000E+00
DOUBLE SUM	9	-0.5911E+00	0.3609E+00	-0.6066E+00	0.0000E+00	0.0000E+00	0.0000E+00

SPATIAL COMB 4

SRSS	9	-0.5914E+00	-0.5246E+00	-0.1715E-01	0.0000E+00	0.0000E+00	0.0000E+00
CQC	9	-0.5913E+00	-0.5783E+00	-0.1674E-01	0.0000E+00	0.0000E+00	0.0000E+00
GROUPING	9	-0.5914E+00	-0.5223E+00	-0.1715E-01	0.0000E+00	0.0000E+00	0.0000E+00
10 %	9	-0.5914E+00	-0.5240E+00	-0.1715E-01	0.0000E+00	0.0000E+00	0.0000E+00
DOUBLE SUM	9	-0.5911E+00	-0.4556E+00	-0.1645E-01	0.0000E+00	0.0000E+00	0.0000E+00

Error in forces
Element 1
SPATIAL COMB 1

SRSS	1	-0.8739E+00	0.2890E+00	0.1581E+00	0.0000E+00	0.1581E+00	0.2890E+00
	2	-0.8739E+00	0.2890E+00	0.1581E+00	0.0000E+00	0.1581E+00	0.2890E+00
CQC	1	-0.8740E+00	0.2420E+00	0.1222E+00	0.0000E+00	0.1222E+00	0.2420E+00
	2	-0.8740E+00	0.2420E+00	0.1222E+00	0.0000E+00	0.1222E+00	0.2420E+00
GROUPING	1	-0.8739E+00	0.3090E+00	0.1581E+00	0.0000E+00	0.1581E+00	0.3090E+00
	2	-0.8739E+00	0.3090E+00	0.1581E+00	0.0000E+00	0.1581E+00	0.3090E+00
10 %	1	-0.8739E+00	0.2998E+00	0.1581E+00	0.0000E+00	0.1581E+00	0.2998E+00
	2	-0.8739E+00	0.2998E+00	0.1581E+00	0.0000E+00	0.1581E+00	0.2998E+00
DOUBLE SUM	1	-0.8738E+00	0.3967E+00	0.1987E+00	0.0000E+00	0.1987E+00	0.3967E+00
	2	-0.8738E+00	0.3967E+00	0.1987E+00	0.0000E+00	0.1987E+00	0.3967E+00

SPATIAL COMB 2

SRSS	1	-0.8739E+00	-0.4844E+00	-0.5368E+00	0.0000E+00	-0.5368E+00	-0.4844E+00
	2	-0.8739E+00	-0.4844E+00	-0.5368E+00	0.0000E+00	-0.5368E+00	-0.4844E+00
CQC	1	-0.8740E+00	-0.5032E+00	-0.5511E+00	0.0000E+00	-0.5511E+00	-0.5032E+00
	2	-0.8740E+00	-0.5032E+00	-0.5511E+00	0.0000E+00	-0.5511E+00	-0.5032E+00
GROUPING	1	-0.8739E+00	-0.4764E+00	-0.5368E+00	0.0000E+00	-0.5368E+00	-0.4764E+00
	2	-0.8739E+00	-0.4764E+00	-0.5368E+00	0.0000E+00	-0.5368E+00	-0.4764E+00
10 %	1	-0.8739E+00	-0.4801E+00	-0.5368E+00	0.0000E+00	-0.5368E+00	-0.4801E+00
	2	-0.8739E+00	-0.4801E+00	-0.5368E+00	0.0000E+00	-0.5368E+00	-0.4801E+00
DOUBLE SUM	1	-0.8738E+00	-0.4413E+00	-0.5205E+00	0.0000E+00	-0.5205E+00	-0.4413E+00
	2	-0.8738E+00	-0.4413E+00	-0.5205E+00	0.0000E+00	-0.5205E+00	-0.4413E+00

SPATIAL COMB 3

SRSS	1	-0.9496E+00	0.2890E+00	-0.5368E+00	0.0000E+00	-0.5368E+00	0.2890E+00
	2	-0.9496E+00	0.2890E+00	-0.5368E+00	0.0000E+00	-0.5368E+00	0.2890E+00
CQC	1	-0.9496E+00	0.2420E+00	-0.5511E+00	0.0000E+00	-0.5511E+00	0.2420E+00
	2	-0.9496E+00	0.2420E+00	-0.5511E+00	0.0000E+00	-0.5511E+00	0.2420E+00
GROUPING	1	-0.9496E+00	0.3090E+00	-0.5368E+00	0.0000E+00	-0.5368E+00	0.3090E+00
	2	-0.9496E+00	0.3090E+00	-0.5368E+00	0.0000E+00	-0.5368E+00	0.3090E+00
10 %	1	-0.9496E+00	0.2998E+00	-0.5368E+00	0.0000E+00	-0.5368E+00	0.2998E+00
	2	-0.9496E+00	0.2998E+00	-0.5368E+00	0.0000E+00	-0.5368E+00	0.2998E+00
DOUBLE SUM	1	-0.9495E+00	0.3967E+00	-0.5205E+00	0.0000E+00	-0.5205E+00	0.3967E+00
	2	-0.9495E+00	0.3967E+00	-0.5205E+00	0.0000E+00	-0.5205E+00	0.3967E+00

SPATIAL COMB 4

SRSS	1	-0.9496E+00	-0.4844E+00	0.1581E+00	0.0000E+00	0.1581E+00	-0.4844E+00
	2	-0.9496E+00	-0.4844E+00	0.1581E+00	0.0000E+00	0.1581E+00	-0.4844E+00
CQC	1	-0.9496E+00	-0.5032E+00	0.1222E+00	0.0000E+00	0.1222E+00	-0.5032E+00
	2	-0.9496E+00	-0.5032E+00	0.1222E+00	0.0000E+00	0.1222E+00	-0.5032E+00
GROUPING	1	-0.9496E+00	-0.4764E+00	0.1581E+00	0.0000E+00	0.1581E+00	-0.4764E+00
	2	-0.9496E+00	-0.4764E+00	0.1581E+00	0.0000E+00	0.1581E+00	-0.4764E+00

	2	-0.9496E+00	-0.4801E+00	0.1581E+00	0.0000E+00	0.1581E+00	-0.4801E+00
DOUBLE SUM	1	-0.9495E+00	-0.4413E+00	0.1987E+00	0.0000E+00	0.1987E+00	-0.4413E+00
	2	-0.9495E+00	-0.4413E+00	0.1987E+00	0.0000E+00	0.1987E+00	-0.4413E+00

Element 9

SPATIAL COMB 1

SRSS	5	-0.5791E+00	0.2716E+00	0.1520E+00	0.0000E+00	0.1520E+00	0.2716E+00
	6	-0.5791E+00	0.2716E+00	0.1520E+00	0.0000E+00	0.1520E+00	0.2716E+00
CQC	5	-0.5782E+00	0.2213E+00	0.1196E+00	0.0000E+00	0.1197E+00	0.2213E+00
	6	-0.5782E+00	0.2213E+00	0.1196E+00	0.0000E+00	0.1197E+00	0.2213E+00
GROUPING	5	-0.5791E+00	0.2850E+00	0.1520E+00	0.0000E+00	0.1520E+00	0.2850E+00
	6	-0.5791E+00	0.2850E+00	0.1520E+00	0.0000E+00	0.1520E+00	0.2850E+00
10 %	5	-0.5791E+00	0.2768E+00	0.1520E+00	0.0000E+00	0.1520E+00	0.2768E+00
	6	-0.5791E+00	0.2768E+00	0.1520E+00	0.0000E+00	0.1520E+00	0.2768E+00
DOUBLE SUM	5	-0.5781E+00	0.3675E+00	0.1885E+00	0.0000E+00	0.1885E+00	0.3675E+00
	6	-0.5781E+00	0.3675E+00	0.1885E+00	0.0000E+00	0.1885E+00	0.3675E+00

SPATIAL COMB 2

SRSS	5	-0.5791E+00	-0.4914E+00	-0.5392E+00	0.0000E+00	-0.5392E+00	-0.4914E+00
	6	-0.5791E+00	-0.4914E+00	-0.5392E+00	0.0000E+00	-0.5392E+00	-0.4914E+00
CQC	5	-0.5782E+00	-0.5115E+00	-0.5521E+00	0.0000E+00	-0.5521E+00	-0.5115E+00
	6	-0.5782E+00	-0.5115E+00	-0.5521E+00	0.0000E+00	-0.5521E+00	-0.5115E+00
GROUPING	5	-0.5791E+00	-0.4860E+00	-0.5392E+00	0.0000E+00	-0.5392E+00	-0.4860E+00
	6	-0.5791E+00	-0.4860E+00	-0.5392E+00	0.0000E+00	-0.5392E+00	-0.4860E+00
10 %	5	-0.5791E+00	-0.4893E+00	-0.5392E+00	0.0000E+00	-0.5392E+00	-0.4893E+00
	6	-0.5791E+00	-0.4893E+00	-0.5392E+00	0.0000E+00	-0.5392E+00	-0.4893E+00
DOUBLE SUM	5	-0.5781E+00	-0.4530E+00	-0.5246E+00	0.0000E+00	-0.5246E+00	-0.4530E+00
	6	-0.5781E+00	-0.4530E+00	-0.5246E+00	0.0000E+00	-0.5246E+00	-0.4530E+00

SPATIAL COMB 3

SRSS	5	-0.8317E+00	0.2716E+00	-0.5392E+00	0.0000E+00	-0.5392E+00	0.2716E+00
	6	-0.8317E+00	0.2716E+00	-0.5392E+00	0.0000E+00	-0.5392E+00	0.2716E+00
CQC	5	-0.8313E+00	0.2213E+00	-0.5521E+00	0.0000E+00	-0.5521E+00	0.2213E+00
	6	-0.8313E+00	0.2213E+00	-0.5521E+00	0.0000E+00	-0.5521E+00	0.2213E+00
GROUPING	5	-0.8317E+00	0.2850E+00	-0.5392E+00	0.0000E+00	-0.5392E+00	0.2850E+00
	6	-0.8317E+00	0.2850E+00	-0.5392E+00	0.0000E+00	-0.5392E+00	0.2850E+00
10 %	5	-0.8317E+00	0.2768E+00	-0.5392E+00	0.0000E+00	-0.5392E+00	0.2768E+00
	6	-0.8317E+00	0.2768E+00	-0.5392E+00	0.0000E+00	-0.5392E+00	0.2768E+00
DOUBLE SUM	5	-0.8312E+00	0.3675E+00	-0.5246E+00	0.0000E+00	-0.5246E+00	0.3675E+00
	6	-0.8312E+00	0.3675E+00	-0.5246E+00	0.0000E+00	-0.5246E+00	0.3675E+00

SPATIAL COMB 4

SRSS	5	-0.8317E+00	-0.4914E+00	0.1520E+00	0.0000E+00	0.1520E+00	-0.4914E+00
	6	-0.8317E+00	-0.4914E+00	0.1520E+00	0.0000E+00	0.1520E+00	-0.4914E+00
CQC	5	-0.8313E+00	-0.5115E+00	0.1196E+00	0.0000E+00	0.1197E+00	-0.5115E+00
	6	-0.8313E+00	-0.5115E+00	0.1196E+00	0.0000E+00	0.1197E+00	-0.5115E+00
GROUPING	5	-0.8317E+00	-0.4860E+00	0.1520E+00	0.0000E+00	0.1520E+00	-0.4860E+00
	6	-0.8317E+00	-0.4860E+00	0.1520E+00	0.0000E+00	0.1520E+00	-0.4860E+00
10 %	5	-0.8317E+00	-0.4893E+00	0.1520E+00	0.0000E+00	0.1520E+00	-0.4893E+00
	6	-0.8317E+00	-0.4893E+00	0.1520E+00	0.0000E+00	0.1520E+00	-0.4893E+00
DOUBLE SUM	5	-0.8312E+00	-0.4530E+00	0.1885E+00	0.0000E+00	0.1885E+00	-0.4530E+00
	6	-0.8312E+00	-0.4530E+00	0.1885E+00	0.0000E+00	0.1885E+00	-0.4530E+00

Element 10

SPATIAL COMB 1

SRSS	6	-0.2251E+00	-0.1920E+00	-0.9147E+00	-0.1920E+00	-0.2251E+00	0.0000E+00
	7	-0.2251E+00	-0.1920E+00	-0.9147E+00	-0.1920E+00	-0.2251E+00	0.0000E+00
CQC	6	-0.8368E-01	-0.2006E+00	-0.9147E+00	-0.2006E+00	-0.8368E-01	0.0000E+00
	7	-0.8368E-01	-0.2006E+00	-0.9147E+00	-0.2006E+00	-0.8368E-01	0.0000E+00
GROUPING	6	-0.2251E+00	-0.1718E+00	-0.9147E+00	-0.1718E+00	-0.2251E+00	0.0000E+00
	7	-0.2251E+00	-0.1718E+00	-0.9147E+00	-0.1718E+00	-0.2251E+00	0.0000E+00
10 %	6	-0.2251E+00	-0.1880E+00	-0.9147E+00	-0.1880E+00	-0.2251E+00	0.0000E+00
	7	-0.2251E+00	-0.1880E+00	-0.9147E+00	-0.1880E+00	-0.2251E+00	0.0000E+00
DOUBLE SUM	6	-0.7353E-01	-0.1541E+00	-0.9147E+00	-0.1541E+00	-0.7354E-01	0.0000E+00
	7	-0.7353E-01	-0.1541E+00	-0.9147E+00	-0.1541E+00	-0.7354E-01	0.0000E+00

SPATIAL COMB 2

SRSS	6	-0.2251E+00	-0.6768E+00	-0.9659E+00	-0.6768E+00	-0.2251E+00	0.0000E+00
	7	-0.2251E+00	-0.6768E+00	-0.9659E+00	-0.6768E+00	-0.2251E+00	0.0000E+00
CQC	6	-0.8368E-01	-0.6803E+00	-0.9659E+00	-0.6803E+00	-0.8368E-01	0.0000E+00
	7	-0.8368E-01	-0.6803E+00	-0.9659E+00	-0.6803E+00	-0.8368E-01	0.0000E+00
GROUPING	6	-0.2251E+00	-0.6687E+00	-0.9659E+00	-0.6687E+00	-0.2251E+00	0.0000E+00
	7	-0.2251E+00	-0.6687E+00	-0.9659E+00	-0.6687E+00	-0.2251E+00	0.0000E+00
10 %	6	-0.2251E+00	-0.6752E+00	-0.9659E+00	-0.6752E+00	-0.2251E+00	0.0000E+00
	7	-0.2251E+00	-0.6752E+00	-0.9659E+00	-0.6752E+00	-0.2251E+00	0.0000E+00
DOUBLE SUM	6	-0.7353E-01	-0.6617E+00	-0.9659E+00	-0.6617E+00	-0.7354E-01	0.0000E+00
	7	-0.7353E-01	-0.6617E+00	-0.9659E+00	-0.6617E+00	-0.7354E-01	0.0000E+00

SPATIAL COMB 3

SRSS	6	-0.6900E+00	-0.1920E+00	-0.9659E+00	-0.1920E+00	-0.6900E+00	0.0000E+00
	7	-0.6900E+00	-0.1920E+00	-0.9659E+00	-0.1920E+00	-0.6900E+00	0.0000E+00
CQC	6	-0.6335E+00	-0.2006E+00	-0.9659E+00	-0.2006E+00	-0.6335E+00	0.0000E+00
	7	-0.6335E+00	-0.2006E+00	-0.9659E+00	-0.2006E+00	-0.6335E+00	0.0000E+00

10 %	6	-0.6900E+00	-0.1880E+00	-0.9659E+00	-0.1880E+00	-0.6900E+00	0.0000E+00
	7	-0.6900E+00	-0.1880E+00	-0.9659E+00	-0.1880E+00	-0.6900E+00	0.0000E+00
DOUBLE SUM	6	-0.6294E+00	-0.1541E+00	-0.9659E+00	-0.1541E+00	-0.6294E+00	0.0000E+00
	7	-0.6294E+00	-0.1541E+00	-0.9659E+00	-0.1541E+00	-0.6294E+00	0.0000E+00

SPATIAL COMB 4

SRSS	6	-0.6900E+00	-0.6768E+00	-0.9147E+00	-0.6768E+00	-0.6900E+00	0.0000E+00
	7	-0.6900E+00	-0.6768E+00	-0.9147E+00	-0.6768E+00	-0.6900E+00	0.0000E+00
CQC	6	-0.6335E+00	-0.6803E+00	-0.9147E+00	-0.6803E+00	-0.6335E+00	0.0000E+00
	7	-0.6335E+00	-0.6803E+00	-0.9147E+00	-0.6803E+00	-0.6335E+00	0.0000E+00
GROUPING	6	-0.6900E+00	-0.6687E+00	-0.9147E+00	-0.6687E+00	-0.6900E+00	0.0000E+00
	7	-0.6900E+00	-0.6687E+00	-0.9147E+00	-0.6687E+00	-0.6900E+00	0.0000E+00
10 %	6	-0.6900E+00	-0.6752E+00	-0.9147E+00	-0.6752E+00	-0.6900E+00	0.0000E+00
	7	-0.6900E+00	-0.6752E+00	-0.9147E+00	-0.6752E+00	-0.6900E+00	0.0000E+00
DOUBLE SUM	6	-0.6294E+00	-0.6617E+00	-0.9147E+00	-0.6617E+00	-0.6294E+00	0.0000E+00
	7	-0.6294E+00	-0.6617E+00	-0.9147E+00	-0.6617E+00	-0.6294E+00	0.0000E+00

Element 23
SPATIAL COMB 1

SRSS	15	0.2145E-01	0.4371E-01	-0.1716E-01	-0.1716E-01	0.0000E+00	0.2145E-01
	11	0.2145E-01	0.4371E-01	-0.1716E-01	-0.1716E-01	0.0000E+00	0.2145E-01
CQC	15	0.2186E-01	-0.3061E-02	-0.1674E-01	-0.1675E-01	0.0000E+00	0.2186E-01
	11	0.2186E-01	-0.3061E-02	-0.1674E-01	-0.1675E-01	0.0000E+00	0.2186E-01
GROUPING	15	0.2145E-01	0.4890E-01	-0.1716E-01	-0.1716E-01	0.0000E+00	0.2145E-01
	11	0.2145E-01	0.4890E-01	-0.1716E-01	-0.1716E-01	0.0000E+00	0.2145E-01
10 %	15	0.2145E-01	0.4512E-01	-0.1716E-01	-0.1716E-01	0.0000E+00	0.2145E-01
	11	0.2145E-01	0.4512E-01	-0.1716E-01	-0.1716E-01	0.0000E+00	0.2145E-01
DOUBLE SUM	15	0.2211E-01	0.1952E+00	-0.1646E-01	-0.1646E-01	0.0000E+00	0.2212E-01
	11	0.2211E-01	0.1952E+00	-0.1646E-01	-0.1646E-01	0.0000E+00	0.2212E-01

SPATIAL COMB 2

SRSS	15	0.2145E-01	-0.5825E+00	-0.6069E+00	-0.6069E+00	0.0000E+00	0.2145E-01
	11	0.2145E-01	-0.5825E+00	-0.6069E+00	-0.6069E+00	0.0000E+00	0.2145E-01
CQC	15	0.2186E-01	-0.6012E+00	-0.6067E+00	-0.6067E+00	0.0000E+00	0.2186E-01
	11	0.2186E-01	-0.6012E+00	-0.6067E+00	-0.6067E+00	0.0000E+00	0.2186E-01
GROUPING	15	0.2145E-01	-0.5804E+00	-0.6069E+00	-0.6069E+00	0.0000E+00	0.2145E-01
	11	0.2145E-01	-0.5804E+00	-0.6069E+00	-0.6069E+00	0.0000E+00	0.2145E-01
10 %	15	0.2145E-01	-0.5820E+00	-0.6069E+00	-0.6069E+00	0.0000E+00	0.2145E-01
	11	0.2145E-01	-0.5820E+00	-0.6069E+00	-0.6069E+00	0.0000E+00	0.2145E-01
DOUBLE SUM	15	0.2211E-01	-0.5219E+00	-0.6066E+00	-0.6066E+00	0.0000E+00	0.2212E-01
	11	0.2211E-01	-0.5219E+00	-0.6066E+00	-0.6066E+00	0.0000E+00	0.2212E-01

SRSS	15	-0.5914E+00	0.4371E-01	-0.6069E+00	-0.6069E+00	0.0000E+00	-0.5914E+00
	11	-0.5914E+00	0.4371E-01	-0.6069E+00	-0.6069E+00	0.0000E+00	-0.5914E+00
CQC	15	-0.5913E+00	-0.3061E-02	-0.6067E+00	-0.6067E+00	0.0000E+00	-0.5913E+00
	11	-0.5913E+00	-0.3061E-02	-0.6067E+00	-0.6067E+00	0.0000E+00	-0.5913E+00
GROUPING	15	-0.5914E+00	0.4890E-01	-0.6069E+00	-0.6069E+00	0.0000E+00	-0.5914E+00
	11	-0.5914E+00	0.4890E-01	-0.6069E+00	-0.6069E+00	0.0000E+00	-0.5914E+00
10 %	15	-0.5914E+00	0.4512E-01	-0.6069E+00	-0.6069E+00	0.0000E+00	-0.5914E+00
	11	-0.5914E+00	0.4512E-01	-0.6069E+00	-0.6069E+00	0.0000E+00	-0.5914E+00
DOUBLE SUM	15	-0.5912E+00	0.1952E+00	-0.6066E+00	-0.6066E+00	0.0000E+00	-0.5912E+00
	11	-0.5912E+00	0.1952E+00	-0.6066E+00	-0.6066E+00	0.0000E+00	-0.5912E+00

SPATIAL COMB 4

SRSS	15	-0.5914E+00	-0.5825E+00	-0.1716E-01	-0.1716E-01	0.0000E+00	-0.5914E+00
	11	-0.5914E+00	-0.5825E+00	-0.1716E-01	-0.1716E-01	0.0000E+00	-0.5914E+00
CQC	15	-0.5913E+00	-0.6012E+00	-0.1674E-01	-0.1675E-01	0.0000E+00	-0.5913E+00
	11	-0.5913E+00	-0.6012E+00	-0.1674E-01	-0.1675E-01	0.0000E+00	-0.5913E+00
GROUPING	15	-0.5914E+00	-0.5804E+00	-0.1716E-01	-0.1716E-01	0.0000E+00	-0.5914E+00
	11	-0.5914E+00	-0.5804E+00	-0.1716E-01	-0.1716E-01	0.0000E+00	-0.5914E+00
10 %	15	-0.5914E+00	-0.5820E+00	-0.1716E-01	-0.1716E-01	0.0000E+00	-0.5914E+00
	11	-0.5914E+00	-0.5820E+00	-0.1716E-01	-0.1716E-01	0.0000E+00	-0.5914E+00
DOUBLE SUM	15	-0.5912E+00	-0.5219E+00	-0.1646E-01	-0.1646E-01	0.0000E+00	-0.5912E+00
	11	-0.5912E+00	-0.5219E+00	-0.1646E-01	-0.1646E-01	0.0000E+00	-0.5912E+00
	12	-0.5912E+00	-0.6305E+00	-0.1645E-01	-0.1645E-01	0.0000E+00	-0.5912E+00

TABLE 17

Avarage and maximum error by R.S.T. for Building 1
SPATIAAL COMBINATION A(SRSS)

DISPLACEMENT

method	Average σ	n	Max.negative error	Max. positive error
SRSS	-0.068	0.126	-0.27	+0.0094
CQC	-0.064	0.076	-0.16	+0.00136
GROUPING	-0.079	0.118	-0.267	+0.032
TEN PERCENT	-0.079	0.118	-0.264	+0.033
DOUBLE SUM	-0.021	0.09	-0.15	+0.19

FORCES

method	Average σ	n	Max.negative error	Max. positive error
SRSS	-0.076	0.156	-0.27	+0.21
CQC	-0.027	0.117	-0.17	+0.18
GROUPING	-0.048	0.151	-0.26	+0.21
TEN PERCENT	-0.0478	0.150	-0.26	+0.21
DOUBLE SUM	0.0189	0.102	-0.14	+0.33

TABLE 18

Average and maximum error by R.S.T for Building 2

SPATIAL COMBINATION A(SRSS)

DISPLACEMENT

Method	Average error	σ_n	Max. Negative error	Max. positive error
SRSS	-0.0674	0.038	-0.12	+0.042
CQC	-0.065	0.036	-0.116	+0.034
GROUPING	-0.0553	0.054	-0.123	+0.042
TEN PERCENT	-0.0553	0.0539	-0.120	+0.043
DOUBLE SUM	-0.05	0.0553	-0.115	+0.051

FORCES

SRSS	-0.0439	0.096	-0.179	+0.192
CQC	-0.014	0.088	-0.1159	+0.187
GROUPING	-0.045	0.096	-0.170	+0.192
TEN PERCENT	-0.045	0.096	-0.170	+0.192
DOUBLE SUM	0.00046	0.095	-0.1153	+0.199

TABLE 19

Average and maximum error by R.S.T.for Building 2
SPATIAL COMBINATION A(SRSS)

DISPLACEMENT

Method	Avrage error	σ_n	Max. Negative error	Max.Positive error
SRSS	+0.079	0.069	-0.0150	+0.188
CQC	+0.025	0.054	-0.120	+0.081
GROUPING	+0.055	0.095	-0.145	+0.194
TEN PERCENT	0.053	0.094	-0.149	+0.190
DUBLE SUM	+0.0283	0.028	-0.016	+0.07

FORCES

SRSS	0.017	0.139	-0.225	+0.1581
CQC	0.028	0.081	-0.084	+0.1186
GROUPING	0.037	0.151	-0.225	+0.158
TEN PERCENT	0.037	0.151	-0.225	+0.158
DOUBLE SUM	0.06	0.11	-0.07	+0.190

APPENDIX -B

```
c***********************************************************************
c                              SPTH.F
c program for mode superposition time integration for space frame
c***********************************************************************
      implicit double precision (a-h, o-z)
c
      common/d1/nnd,nm,imode,nnf,td,h
c
      common/ii1/bm(200),node(600,2),bmrz(200),bmry(200),bmrx(200)
      common/ii2/freq(25),eta(25),amp(25,3)
      common/ii3/af(600,12,25)
c
      common/c1/gud(6),bf(600,12,3)
      common/c2/sp1(12,1),sp2(12,1),es(12,12)
      common/c4/zpa,afmax(600,6,3),y0m(25),ya0m(25),yv0m(25)
      common/c5/afb(600,12,25)
c
      character *6 f1(3)
c***********************************************************************
      write(*,*)'give nnd,nnf,nm,imode,td,h,hth,zpa'
      read(*,*)nnd,nnf,nm,imode,td,h,hth,zpa
      write(*,*)'name of  eq. acc. data file'
      read(*,101)f1(1)
  101 format(a6)
      write(*,*)'give Yo ,YVo,YAo'
      read(*,*)yy0,yyv0,yya0
      write(*,*)yy0,yyv0,yya0
      open (unit=1,file=f1(1),status='old')
      open (unit=2,file='thd',status='new')
      open(unit=12,file='test.els',status='old')
c     reading test.inp
      call dinpt1
      write(*,*)'test.inp read'
      call dinpt2
      write(*,*)'test.out read'
      nts =td/hth
      nts2=hth/h
c     calculation of response in each direction
      do 300 igd =1,3
      ts=0.0
      ug0=yya0
      do 304 it =1,nts
      write(*,*)'igd  ', igd,'it  ',it
```

```
      read(1,*)ug1
      do 304 it2 =1,nts2
      ts=ts+h
      ug2=ug0+((ug1-ug0)/nts2)*it2
      ugav =(ug0+ug2)/2.0
      ug0=ug2
      ug=ugav*zpa
      if(igd .eq. 2)then
      ug=ug*0.5
      else
      endif
      do 302 im = 1,imode
c     calculate ye
      frr=2.0*3.1415927*freq(im)
c     constants
      ac1 =(frr**2)+(4.0/h**2)+(4.0*frr*eta(im))/h
      bc1 =4.0/h**2 +4.0*frr*eta(im)/h
      cc1 =4.0/h +2.0*frr*eta(im)
      if(it .eq. 1)then
      y0=yy0
      yv0=yyv0
      ya0=yya0
      else
      y0=y0m(im)
      ya0=ya0m(im)
      yv0=yv0m(im)
      endif
      ye=(y0*bc1+yv0*cc1+(ya0-amp(im,igd)*ug))/ac1
      yae=(4.0/h**2)*ye -(4.0/h**2)*y0 -(4.0/h)*yv0 -ya0
      yve=(2.0/h)*(ye-y0)-yv0
      y0m(im)=ye
      ya0m(im)=yae
      yv0m(im)=yve
c     disp. of each d.o.f in each mode
      do 308 kn =1,nnd
      do 310 id =1,6
      if(igd .eq. id)then
      afb(kn,id,im)=ye*af(kn,id,im)
      else
      afb(kn,id,im)=0.0
      endif
  310 continue
  308 continue
  302 continue
c     calculation of final disp.
      do 312 kn =1,nnd
```

```
      do 314 id =1,6
         sum =0.0
      do 316 im =1,imode
         sum =sum +afb(kn,id,im)
  316 continue
      afb(kn,id,igd)=sum
      if(it .eq. 1)then
      afmax(kn,id,igd)=sum
      elseif(abs(afmax(kn,id,igd)) .gt. abs(sum))then
      go to 314
      else
      afmax(kn,id,igd)=sum
      endif
  314 continue
  312 continue
      write(*,313)ts,(afb(kn,igd,igd),kn=1,nnf)
      write(2,313)ts,(afb(kn,igd,igd),kn=1,nnf)
  313 format(1x,f5.3,6e13.5)
c     calculation of forces
      do 318 km =1,nm
      call esread(es,ign)
      nd1 =node(km,1)
      nd2 =node(km,2)
      do 320 id1=1,6
      sp1(id1,1)=0.0
      sp1(id1,1)=afb(nd1,id1,igd)
  320 continue
      do 322 id2=7,12
      idd=id2-6
      sp1(id2,1)=0.0
      sp1(id2,1)=afb(nd2,idd,igd)
  322 continue
      call matmu(es,sp1,sp2,12,12,12,1)
      do 324 id =1,12
      if(it .eq. 1)then
      bf(km,id,igd)=sp2(id,1)
      elseif(abs(bf(km,id,igd)) .gt. abs(sp2(id,1)))then
      go to 324
      else
      bf(km,id,igd)=sp2(id,1)
      endif
  324 continue
  318 continue
      rewind(12)
  304 continue
      rewind(1)
```

```
300 continue
    close(1)
    close(12)
c   forces and disp. calculated in each direction
c   final response
c   deformations
    do 326 kn =1,nnd
    do 328 id =1,6
    disp =0.0
    do 330 igd =1,3
    disp =disp +afmax(kn,id,igd)**2
330 continue
    af(kn,id,1)=0.0
    af(kn,id,1)=sqrt(disp)
328 continue
326 continue
c   forces
    do 331 km=1,nm
    do 332 id=1,12
    force=0.0
    do 334 igd=1,3
    force=force+bf(km,id,igd)**2
334 continue
    bf(km,id,1)=0.0
    bf(km,id,1)=sqrt(force)
332 continue
331 continue
c   writing results
c   deformations
    open(unit=4,file='disp.out',status='new')
    write(4,336)
336 format(25('****')//20x,'NODAL DISP. BY THA'//25('****'),/)
    write(4,337)
337 format(/1x,'method',5x,'node',7x,'Ux',14x,'Uy',14x,'Uz',13x,
   c'Rxx',13x,'Ryy',13x,'Rzz',/)
    do 338 jn =1,nnf
    do 340 id =1,6
    sp2(id,1)=af(jn,id,1)
340 continue
    call dwrite(jn,sp2,1)
338 continue
    close(4)
c   force
    open(unit=7,file='force.out',status ='unknown')
    write(7,341)
341 format(25('****')//15x,'FORCES in global by T.H.A.',//25('****'),/
```

```
c )
      write(7,342)
  342 format(1x,'method',5x,'node',7x,'Fx',14x,'Fy',14x,'Fz',13x,
     c'Mxx',13x,'Myy',13x,'Mzz',/)
      do 344 km =1,nm
      nd1=node(km,1)
      nd2=node(km,2)
      do 346 is=1,12
      sp2(is,1)=bf(km,is,1)
  346 continue
      call rwrite(nd1,nd2,sp2,1,km)
  344 continue
      close(7)
      write(*,*)'result in file DISP.OUT & FORCE.OUT'
      write(*,*)'program completed'
      stop
      end
c*********************************************************************
c                       This reads data from test.inp
c---------------------------------------------------------------------
          subroutine dinpt1
      implicit double precision (a-h ,o-z)
c---------------------------------------------------------------------
      common/d1/nnd,nm,imode,nnf,td,h
c
      common/ii1/bm(200),node(600,2),bmrz(200),bmry(200),bmrx(200)
      common/ii2/freq(25),eta(25),amp(25,3)
      common/ii3/af(600,12,25)
c
      common/c1/gud(6),bf(600,12,3)
      common/c2/sp1(12,1),sp2(12,1),es(12,12)
c
      character *50 cfn
c---------------------------------------------------------------------
      open(unit=14,file='test.inp',status='old')
      do 200 in =1,nnd
      read(14,*)i1,n11,n12,n13,ydz1,ydz2,ydz3,n14,bm(i1),bmrz(i1),
     1bmry(i1),bmrx(i1)
c     write(13,102)i1,bm(i1),bmrz(i1),bmry(i1),bmrx(i1)
  102 format(1x,i5,4f8.2)
  200 continue
      read(14,103)cfn
  103 format(a50)
      write(*,103)cfn
      do 202 im=1,nm
      read(14,*)k1,ydz1,ydz2,ydz3,ydz4,ydz5,ydz6,ydz7,ydz8,node(k1,2),
```

```
     1node(k1,1),nl1,nl2,nl3,ydz9
c     write(13,104)k1,node(k1,2),node(k1,1)
  104 format(1x,3i6)
      write(*,104)k1,node(k1,2),node(k1,1)
  202 continue
      close(14)
      return
      end
c*********************************************************************
c          This reads data from test.out
c---------------------------------------------------------------------
      subroutine dinpt2
      implicit double precision (a-h ,o-z)
c--------------------------------------------------------------------
      common/d1/nnd,nm,imode,nnf,td,h
c
      common/ii1/bm(200),node(600,2),bmrz(200),bmry(200),bmrx(200)
      common/ii2/freq(25),eta(25),amp(25,3)
      common/ii3/af(600,12,25)
c
      common/c1/gud(6),bf(600,12,3)
      common/c2/sp1(12,1),sp2(12,1),es(12,12)
c
      character cf1*6,cf2*4,cf3*4,cf4*4,cf5*5,cf6*5
c---------------------------------------------------------------------
      open(unit=15,file='test.out',status='old')
      do 300 im =1,imode
      read(15,100)cf1,nl1,ifn,cf2,freq(ifn),cf3,eta(ifn),cf4,amp(ifn,1),
     1cf5,amp(ifn,2),cf6,amp(ifn,3)
  100 format(a6,2i4,a4,e13.5,a4,f8.4,a4,e13.5,a5,e13.5,a5,e13.5)
c     write(13,100)cf1,nl1,ifn,cf2,freq(ifn),cf3,eta(ifn),cf4,
c    1amp(ifn,1),cf5,amp(ifn,2),cf6,amp(ifn,3)
      write(*,100)cf1,nl1,ifn,cf2,freq(ifn),cf3,eta(ifn),cf4,amp(ifn,1),
     1cf5,amp(ifn,2),cf6,amp(ifn,3)
c     write(*,*)'press return to continue pause'
      do 302 in =1,nnf
         read(15,*)inp,(af(inp,jd,im),jd=1,6)
         write(*,102)inp,(af(inp,jd,im),jd=1,6)
  102 format(1x,i4,6e13.5)
  302 continue
      ll1=nnf+1
      do 304 jn=ll1,nnd
      do 304 jd=1,6
         af(jn,jd,im)=0.0
  304 continue
  300 continue
```

```
      close(15)
      return
      end
c***********************************************************************
c                    This reads test.els
c-----------------------------------------------------------------------
      subroutine esread(es,ibm)
      implicit double precision (a-h,o-z)
      dimension es(12,12)
c-----------------------------------------------------------------------
      read(12,*)ibm,((es(i,j),j=i,12),i=1,12)
c     write(*,*)ibm,((es(i,j),j=i,12),i=1,12)
      do 10 i=1,12
      do 10 j=i,12
      if(i.eq.j)go to 10
      es(j,i)=es(i,j)
   10 continue
c     write(*,*)'element  ', ibm
c     write(*,12)((es(i,j),j=1,12),i=1,12)
   12 format(1x,6e13.5)
      return
      end
c***********************************************************************
c                    This is for writing result
c-----------------------------------------------------------------------
      subroutine rwrite(nd1,nd2,sp1,jmm,km)
      implicit double precision (a-h,o-z)
      dimension sp1(12,12)
c-----------------------------------------------------------------------
      write(7,1)km
    1 format(10x,'Element',5x,i4/)
      if(jmm .eq.1)then
      write(7,3)nd1,(sp1(i,1),i=1,6),nd2,(sp1(i,1),i=7,12)
    3 format(1x,'SRSS',6x,i5,6e16.6/11x,i5,6e16.6/)
      else
      endif
      return

      end
c***********************************************************************
c
c     it performs matrix multiplication of two matrices
c
      subroutine matmu(a,b,c,ia,ja,ib,jb)
      implicit double precision (a-h,o-z)
      dimension a(ia,ja),b(ib,jb),c(ia,jb)
```

```
      do 4001 mi=1,ia
      do 4001 mj=1,jb
        c(mi,mj)=0.0
      do 4002 mk=1,ia
        aa=a(mi,mk)
        bb=b(mk,mj)
      if(aa.eq.0.0)go to 4002
        if(bb.eq.0.0)go to 4002
        c(mi,mj)=c(mi,mj)+aa*bb
 4002 continue
 4001 continue
c     write(2,4003)((c(i,j),j=1,12),i=1,12)
 4003 format(1x,/,'c',6e14.6)
      return
      end
c**********************************************************************
c                   This is for writing result disp.
c----------------------------------------------------------------------
      subroutine dwrite(nd1,sp1,jmm)
      implicit double precision (a-h,o-z)
      dimension sp1(12,1)
c----------------------------------------------------------------------
      if(jmm .eq.1)then
      write(4,2)nd1,(sp1(i,1),i=1,6)
    2 format(/1x,'SRSS',6x,i5,6e16.6)
      else
      endif
      return
      end
```

APPENDIX - C

```
c*********************************************************************
c      program for dynamic analysis (DA25.F)
c      calculates disp. and element forces by R.S.T(mode combination)
c*********************************************************************
       implicit double precision (a-h ,o-z)
c---------------------------------------------------------------------
       common/d1/nnd,nm,imode,dofm,nnf,sfac,td,nmco
       common/d2/sa(25,3)
c
       common/ii1/bm(200),node(600,2),bmrz(200),bmry(200),bmrx(200)
       common/ii2/freq(25),eta(25),amp(25,3)
       common/ii3/af(600,12,25)
c
       common/c1/gud(6),bf(600,12,5)
       common/c2/ngr,mgr(25),mdgr(25,25)
       common/c3/sp1(12,3),sp2(12,1),es(12,12)
c
c*********************************************************************
       open(unit=10,file='disp.bin',access='direct',recl=48)
       open(unit=11,file='mdisp.bin',access='direct',recl=48)
       open(unit=12,file='test.els',status='old')
       open(unit=13,file='rst.force',status='unknown')
       open(unit=1,file='force.bin',access='direct',recl=100)
       open(unit=2,file='mforce.bin',access='direct',recl=100)
       open(unit=3,file='rst.disp',status='unknown')
c---------------------------------------------------------------------
       write(*,101)
   101 format(1x,'give valu of nnd,nm,imode,dofm,nnf,sfac,td,nmco',/)
       read(*,*) nnd,nm,imode,dofm,nnf,sfac,td,nmco
       write(13,102) nnd,nm,imode,dofm,nnf,sfac,td,nmco
   102 format(1x,3i5,e13.5,i5,2e13.5,i5/)
       if(imode .gt. 25)then
       write(*,*)'imode > 25'
       stop
       elseif(nnd .gt. 200)then
       write(*,*)'nnd > 200'
       stop
          elseif(nm .gt. 600)then
       write(*,*)'nm > 600'
       stop
          elseif(nmco .gt. 5)then
       write(*,*)'nmco > 5'
       stop
```

```
      else
      endif
c     reading from test.inp
      call dinpt1
      write(*,*)'test.inp read'
      call dinpt2
      write(*,*)'test.out read'
      write(*,*)'give values of Sa for T and damp & direction'
      do 999 im=1,imode
         freq(im)=2.0*3.1415927*freq(im)
         timp=2.0*3.1415927/freq(im)
         write(*,104)timp,eta(im)
  104 format(1x,'Type Sax Say Saz for T',2x,f10.5,'dmp=',f8.4,/)
  999    read(*,*)sa(im,1),sa(im,2),sa(im,3)
c     calculation of nodal displacement
      do 200 igd =1,3
      write(*,*)'direction ', igd
      do 202 im=1,imode
      do 204 kn=1,nnd
      do 50 i=1,6
   50 gud(i)=0.0
      kd=igd
      gudkd=amp(im,igd)*af(kn,kd,im)*sa(im,igd)*sfac
      gud(kd)=gudkd/(freq(im)*freq(im))+gud(kd)
         nr=nnd*imode*(igd-1)+(im-1)*nnd+kn
  204    write(10,rec=nr)(gud(j),j=1,6)
      do 203 km =1,nm
         nd1=node(km,1)
         nd2=node(km,2)
         nr1=nnd*imode*(igd-1)+(im-1)*nnd+nd1
         nr2=nnd*imode*(igd-1)+(im-1)*nnd+nd2
         read(10,rec=nr1)(sp1(i,1),i=1,6)
         read(10,rec=nr2)(sp1(i,1),i=7,12)
         call esread(es,ig1)
c        write(*,150)km,ig1
c        write(*,*)'                pause'
c        pause
  150 format(1x,'esread for element',i4,1x,'ig1',i4)
      call matmu(es,sp1,sp2,12,12,12,1)
c     write(*,*)'matmu called for elem',km
      mr1=(igd-1)*imode*nm +(im-1)*nm+km
      write(1, rec=mr1)km,(sp2(i,1),i=1,12)
c     write(*,152)km
  152 format(1x,'force calculated for element',i4)
  203 continue
      rewind 12
```

```
c      write(*,*) 'test.els rewined  pause'
c      pause
  202 continue
  200 continue
      write(*,*)'disp.in each directions calculated'
      write(*,*)'forces in each directions calculated'
c      modal combination for each direction
      do 208 igd =1,3
      do 210 im =1,imode
      do 210 kn =1,nnd
         nr=nnd*imode*(igd-1)+(im-1)*nnd+kn
  210    read(10,rec=nr)(af(kn,kd,im),kd=1,6)
         call srss(6,nnd)
c        write(*,*)'srss called'
         call cqc(6,nnd)
c        write(*,*)'cqc called'
         call group(6,nnd)
c        write(*,*)'group called'
         call tenper(6,nnd)
c        write(*,*)'tenper called'
         call dsum(6,nnd)
c        write(*,*)'dsum called'
         write(*,106)igd
  106 format(1x,'disp. combination done for direction',1x,i4)
c      writing in direct access form
      do 212 jn =1,nnd
      do 212 jmm=1,nmco
         nr2=(igd-1)*nnd*nmco+(jn-1)*nmco+jmm
  212    write(11,rec=nr2)(bf(jn,id,jmm),id=1,6)
      do 211 im =1,imode
      do 211 km =1,nm
      mr1=(igd-1)*imode*nm+(im-1)*nm+km
  211 read(1,rec=mr1)ig1,(af(km,kd,im),kd=1,12)
      call srss(12,nm)
c      write(*,*)'srss called'
      call cqc(12,nm)
c      write(*,*)'cqc called'
      call group(12,nm)
c      write(*,*)'group called'
      call tenper(12,nm)
c      write(*,*)'tenper called'
      call dsum(12,nm)
c      write(*,*)'dsum called'
      write(*,154)igd
  154 format(1x,'force combined for direction ',i4)
      do 213 jm =1,nm
```

```
      do 213 jmm=1,nmco
      mr2=(igd-1)*nm*nmco+(jm-1)*nmco+jmm
  213 write(2,rec=mr2)(bf(jm,id,jmm),id=1,12)
  208 continue
      write(*,*)'modally combined disp. written in mdisp.bin'
      write(*,*)'modally combined force written in mforce.bin'
      close(10,status='delete')
      close(1,status='delete')
      write(*,*)'disp.bin deleted'
      write(*,*)'force.bin deleted'
c     calculation of responses
      write(13,103)
  103 format(25('****')//20x,'ELEMENT FORCES IN GLOBAL',//25('****'),/)
      do 214 in =1,nm
      nd1=node(in,1)
      nd2=node(in,2)
c     method A
c     writing heading
         write(13,110)in
  110 format(/11x,'ELEMENT =',i4/11x,'spatial combination A (srss)',/1x,
     1'method',5x,'node',7x,'Fx',14x,'Fy',14x,'Fz',13x,'Mxx',13x,'Myy',
     2 13x,'Mzz',/)
      do 216 jmm =1,nmco
      do 218 igd =1,3
         mr1=(in-1)*nmco+jmm+(igd-1)*nm*nmco
         read(2,rec=mr1)(sp1(i,igd),i=1,12)
  218 continue
      do 219 is =1,12
  219    sp2(is,1)=sqrt(sp1(is,1)**2+sp1(is,2)**2+sp1(is,3)**2)
c        write(*,108)in
  108 format(1x,'mforce.bin  for element',i4,'method A',/)
c        write(*,*)'press enter for continu process paused'
c     pause
c     writing heading
         call rwrite(nd1,nd2,sp2,jmm)
  216 continue
      write(*,*)'method A completed'
c     method B
c     writing heading
      write(13,112)
  112 format(/11x,'spatial combination B (R=R1+0.4R2+0.4R3)',/)
      do 220 jmm =1,nmco
         do 222 igd =1,3
         mr1=(in-1)*nmco+jmm+(igd-1)*nm*nmco
         read(2,rec=mr1)(sp1(i,igd),i=1,12)
  222    continue
```

```
      do 226 is =1,12
 226     sp2(is,1)=sp1(is,1)+0.4*sp1(is,2)+0.4*sp1(is,3)
      call rwrite(nd1,nd2,sp2,jmm)
 220  continue
      write(*,*)'method B completed'
c     method C
c     writing heading
      write(13,114)
 114  format(/11x,'spatial combination C (R=0.4R1+R2+0.4R3)',/)
      do 234 jmm =1,nmco
         do 228 igd =1,3
         mr1=(in-1)*nmco+jmm+(igd-1)*nm*nmco
         read(2,rec=mr1)(sp1(i,igd),i=1,12)
 228     continue
      do 232 is =1,12
 232     sp2(is,1)=0.4*sp1(is,1)+sp1(is,2)+0.4*sp1(is,3)
      call rwrite(nd1,nd2,sp2,jmm)
 234  continue
      write(*,*)'method C completed'
c     method D
c     writing heading
      write(13,116)
 116  format(/11x,'spatial combination D (R=0.4R1+0.4R2+R3)',/)
      do 236 jmm =1,nmco
         do 238 igd =1,3
         mr1=(in-1)*nmco+jmm+(igd-1)*nm*nmco
         read(2,rec=mr1)(sp1(i,igd),i=1,12)
 238     continue
      do 242 is =1,12
 242     sp2(is,1)=0.4*sp1(is,1)+0.4*sp1(is,2)+sp1(is,3)
      call rwrite(nd1,nd2,sp2,jmm)
 236  continue
      write(*,*)'method D completed'
 214  continue
c     calculation of displacement
      write(3,162)
 162  format(25('****')//20x,' NODAL  DISP. IN GLOBAL',//25('****'),/)
      do 250 jn =1,nnf
c     method A
c     writing heading
         write(3,160)jn
 160  format(/11x,'  NODE  =',i4/11x,'spatial combination A (srss)',/1x,
     1'method',5x,'node',7x,'Ux',14x,'Uy',14x,'Uz',13x,'Rxx',13x,'Ryy',
     2 13x,'Rzz',/)
      do 252 jmm =1,nmco
      do 254 igd =1,3
```

```
         nr2 =(igd-1)*nnd*nmco +(jn-1)*nmco +jmm
  254 read(11,rec=nr2)(sp1(i,igd),i=1,6)
      do 256 is=1,6
  256 sp2(is,1)=sqrt(sp1(is,1)**2+sp1(is,2)**2+sp1(is,3)**2)
  252 call dwrite(jn,sp2,jmm)
      write(*,*)'method A completed'
c     method B
      write(3,112)
      do 258 jmm =1,nmco
      do 260 igd =1,3
         nr2 =(igd-1)*nnd*nmco +(jn-1)*nmco +jmm
  260 read(11,rec=nr2)(sp1(i,igd),i=1,6)
      do 262  is =1,6
  262 sp2(is,1)=sp1(is,1)+0.4*sp1(is,2)+0.4*sp1(is,3)
  258 call dwrite(jn,sp2,jmm)
      write(*,*)'method B completed'
c     method C
      write(3,114)
      do 264 jmm =1,nmco
      do 266 igd =1,3
         nr2 =(igd-1)*nnd*nmco +(jn-1)*nmco +jmm
  266 read(11,rec=nr2)(sp1(i,igd),i=1,6)
      do 268  is =1,6
  268 sp2(is,1)=0.4*sp1(is,1)+sp1(is,2)+0.4*sp1(is,3)
  264 call dwrite(jn,sp2,jmm)
      write(*,*)'method C completed'
c     method D
      write(3,116)
      do 270 jmm =1,nmco
      do 272 igd =1,3
         nr2 =(igd-1)*nnd*nmco +(jn-1)*nmco +jmm
  272 read(11,rec=nr2)(sp1(i,igd),i=1,6)
      do 274  is =1,6
  274 sp2(is,1)=0.4*sp1(is,1)+0.4*sp1(is,2)+sp1(is,3)
  270 call dwrite(jn,sp2,jmm)
      write(*,*)'method D completed'
  250 continue
      close(11,status='delete')
      close(12)
      close(13)
      close(2,status='delete')
      close(3)
      write(*,*)'program completed result in file RST.FORCE'
      write(*,*)'program completed result in file RST.DISP'
      stop
      end
```

```
c*************************************************************************
c                    This reads data from test.inp
c-------------------------------------------------------------------------
        subroutine dinpt1
      implicit double precision (a-h ,o-z)
c-------------------------------------------------------------------------
      common/d1/nnd,nm,imode,dofm,nnf,sfac,td,nmco
c
      common/ii1/bm(200),node(600,2),bmrz(200),bmry(200),bmrx(200)
      common/ii2/freq(25),eta(25),amp(25,3)
      common/ii3/af(600,12,25)
c
      common/c1/gud(6),bf(600,12,5)
      common/c2/ngr,mgr(25),mdgr(25,25)
      common/c3/sp1(12,3),sp2(12,1),es(12,12)
c
        character *50 cfn
c-------------------------------------------------------------------------
      open(unit=14,file='test.inp',status='old')
      do 200 in =1,nnd
      read(14,*)i1,n11,n12,n13,ydz1,ydz2,ydz3,n14,bm(i1),bmrz(i1),
     1bmry(i1),bmrx(i1)
      write(13,102)i1,bm(i1),bmrz(i1),bmry(i1),bmrx(i1)
  102 format(1x,i5,4f8.2)
  200 continue
      read(14,103)cfn
  103 format(a50)
      write(*,103)cfn
      do 202 im=1,nm
      read(14,*)k1,ydz1,ydz2,ydz3,ydz4,ydz5,ydz6,ydz7,ydz8,node(k1,2),
     1node(k1,1),n11,n12,n13,ydz9
      write(13,104)k1,node(k1,2),node(k1,1)
  104 format(1x,3i6)
      write(*,104)k1,node(k1,2),node(k1,1)
  202 continue
      close(14)
      return
      end
c*************************************************************************
c            This reads data from test.out
c-------------------------------------------------------------------------
      subroutine dinpt2
      implicit double precision (a-h ,o-z)
c-------------------------------------------------------------------------
      common/d1/nnd,nm,imode,dofm,nnf,sfac,td,nmco
c
```

```
      common/ii1/bm(200),node(600,2),bmrz(200),bmry(200),bmrx(200)
      common/ii2/freq(25),eta(25),amp(25,3)
      common/ii3/af(600,12,25)
c
      common/c1/gud(6),bf(600,12,5)
      common/c2/ngr,mgr(25),mdgr(25,25)
      common/c3/sp1(12,3),sp2(12,1),es(12,12)
c
      character cf1*6,cf2*4,cf3*4,cf4*4,cf5*5,cf6*5
c-----------------------------------------------------------------------
      open(unit=15,file='test.out',status='old')
      do 300 im =1,imode
      read(15,100)cf1,nl1,ifn,cf2,freq(ifn),cf3,eta(ifn),cf4,amp(ifn,1),
     1cf5,amp(ifn,2),cf6,amp(ifn,3)
  100 format(a6,2i4,a4,e13.5,a4,f8.4,a4,e13.5,a5,e13.5,a5,e13.5)
      write(13,100)cf1,nl1,ifn,cf2,freq(ifn),cf3,eta(ifn),cf4,
     1amp(ifn,1),cf5,amp(ifn,2),cf6,amp(ifn,3)
      write(*,100)cf1,nl1,ifn,cf2,freq(ifn),cf3,eta(ifn),cf4,amp(ifn,1),
     1cf5,amp(ifn,2),cf6,amp(ifn,3)
c     write(*,*)'press return to continue pause'
      do 302 in =1,nnf
         read(15,*)inp,(af(inp,jd,im),jd=1,6)
         write(*,102)inp,(af(inp,jd,im),jd=1,6)
  102 format(1x,i4,6e13.5)
  302 continue
      l11=nnf+1
      do 304 jn=l11,nnd
      do 304 jd=1,6
         af(jn,jd,im)=0.0
  304 continue
  300 continue
      close(15)
      return
      end
c**********************************************************************
c                    This reads test.els
c-----------------------------------------------------------------------
      subroutine esread(es,ibm)
      implicit double precision (a-h,o-z)
      dimension es(12,12)
c-----------------------------------------------------------------------
      read(12,*)ibm,((es(i,j),j=i,12),i=1,12)
      do 10 i=1,12
      do 10 j=i,12
      if(i.eq.j)go to 10
      es(j,i)=es(i,j)
```

```
   10 continue
c     write(*,*)'element  ', ibm
c     write(*,12)((es(i,j),j=1,12),i=1,12)
   12 format(1x,6e13.5)
      return
      end
c*************************************************************************
c                     This is for writing result
c-------------------------------------------------------------------------
      subroutine rwrite(nd1,nd2,sp1,jmm)
      implicit double precision (a-h,o-z)
      dimension sp1(12,12)
c-------------------------------------------------------------------------
      if(jmm .eq.1)then
      write(13,5)nd1,(sp1(i,1),i=1,6),nd2,(sp1(i,1),i=7,12)
    5 format(1x,'SRSS',6x,i5,6e16.6/11x,i5,6e16.6)
      elseif(jmm .eq.2)then
      write(13,6)nd1,(sp1(i,1),i=1,6),nd2,(sp1(i,1),i=7,12)
    6 format(1x,'CQC',7x,i5,6e16.6/11x,i5,6e16.6)
      elseif(jmm .eq.3)then
      write(13,7)nd1,(sp1(i,1),i=1,6),nd2,(sp1(i,1),i=7,12)
    7 format(1x,'GROUPING',2x,i5,6e16.6/11x,i5,6e16.6)
      elseif(jmm .eq.4)then
      write(13,8)nd1,(sp1(i,1),i=1,6),nd2,(sp1(i,1),i=7,12)
    8 format(1x,'10 %',6x,i5,6e16.6/11x,i5,6e16.6)
      elseif(jmm .eq.5)then
      write(13,9)nd1,(sp1(i,1),i=1,6),nd2,(sp1(i,1),i=7,12)
    9 format(1x,'DOUBLE SUM',i5,6e16.6/11x,i5,6e16.6)
      else
      endif
      return
      end
c*************************************************************************
c     subroutine calculates by srss method
c_________________________________________________________________________
      subroutine srss(nd,mnd)
      implicit double precision (a-h,o-z)
      common/d1/nnd,nm,imode,dofm,nnf,sfac,td,nmco
c
      common/ii1/bm(200),node(600,2),bmrz(200),bmry(200),bmrx(200)
      common/ii2/freq(25),eta(25),amp(25,3)
      common/ii3/af(600,12,25)
c
      common/c1/gud(6),bf(600,12,5)
      common/c2/ngr,mgr(25),mdgr(25,25)
      common/c3/sp1(12,3),sp2(12,1),es(12,12)
```

```
c_______________________________________________________________________
c
      do 10 in =1,mnd
      do 11 id =1,nd
      rs=0.0
      bf(in,id,1)=0.0
      do 12 im=1,imode
      rs=rs+af(in,id,im)*af(in,id,im)
   12 continue
      rs = sqrt(rs)
      bf(in,id,1)=bf(in,id,1)+rs
   11 continue
   10 continue
      return
      end
c***********************************************************************
c     subroutine calculates by CQC method
c_______________________________________________________________________
c
      subroutine cqc(nd,mnd)
      implicit double precision (a-h,o-z)
      common/d1/nnd,nm,imode,dofm,nnf,sfac,td,nmco
c
      common/ii1/bm(200),node(600,2),bmrz(200),bmry(200),bmrx(200)
      common/ii2/freq(25),eta(25),amp(25,3)
      common/ii3/af(600,12,25)
c
      common/c1/gud(6),bf(600,12,5)
      common/c2/ngr,mgr(25),mdgr(25,25)
      common/c3/sp1(12,3),sp2(12,1),es(12,12)
c_______________________________________________________________________
      do 20 in =1,mnd
      do 21 id =1,nd
         rs =0.0
         bf(in,id,2)=0.0
      do 22 im =1,imode
      do 23 ik =1,imode
         ar=freq(ik)/freq(im)
      anum=8.*(sqrt(eta(im)*eta(ik)))*(eta(im)+ar*eta(ik))*(ar**1.5)
         dnom1=(1.0-ar**2)**2
         dnom2=4.0*eta(im)*eta(ik)*ar*(1.0+ar**2)
         dnom3=4.0*(eta(im)**2+eta(ik)**2)*(ar**2)
         denom=dnom1+dnom2+dnom3
         cross = anum/denom
        rs =rs + cross*af(in,id,im)*af(in,id,ik)
c     write(*,25)im,ik,cross
```

```
   25 format(1x,'cqc  cross(',i2,',',i2,') =',e14.6)
   23 continue
   22 continue
      rs =sqrt(rs)
      bf(in,id,2)=bf(in,id,2)+rs
   21 continue
   20 continue
c     write(*,55)((bf(i,j,2),j=1,id),i=1,mnd)
   55 format(1x,'cqc bf',6e13.5)
      return
      end
c*************************************************************************
c     subroutine calculates by GROUPING method
c_________________________________________________________________________
      subroutine group(nd,mnd)
      implicit double precision (a-h,o-z)
      common/d1/nnd,nm,imode,dofm,nnf,sfac,td,nmco
c
      common/ii1/bm(200),node(600,2),bmrz(200),bmry(200),bmrx(200)
      common/ii2/freq(25),eta(25),amp(25,3)
      common/ii3/af(600,12,25)
c
      common/c1/gud(6),bf(600,12,5)
      common/c2/ngr,mgr(25),mdgr(25,25)
      common/c3/sp1(12,3),sp2(12,1),es(12,12)
c_________________________________________________________________________
      ig =1
      ign =1
   32 mgr(ign)=1
      im =ig
      cf=1.1*freq(im)
      imgr=1
      mdgr(ign,imgr) = im
      jm =im +1
      if(jm .gt. imode)go to 35
   33 if(freq(jm) .le. cf)then
      imgr=imgr+1
      mdgr(ign,imgr)=jm
      mgr(ign)=imgr
      jm=jm+1
      if(jm .gt. imode)go to 35
      go to 33
      else
      ig=jm
      ign=ign+1
      endif
```

```
      if(ig .eq. imode)go to 34
   34 go to 32
   35 ngr=ign
c     write(*,36)ngr
   36 format(1x,'no. of groups =',i3/)
      do 37 i =1,ngr
c     write(*,38)i,mgr(i),(mdgr(i,ib),ib=1,mgr(i))
   38 format(1x,'group=',i3,2x,'total modes',i3,2x,'modes =',25i3/)
c
   37 continue
c     write(*,*)'      pause'
c     pause
      do 100 in =1,mnd
      do 102 id =1,nd
         res=0.0
         bf(in,id,3)=0.0
      do 104 im =1,imode
         res =res +af(in,id,im)*af(in,id,im)
  104 continue
         cross =0.0
      do 106 ig =1,ngr
      do 108 ia =1,mgr(ig)
         la=mdgr(ig,ia)
      do 110 ib =1,mgr(ig)
         ma =mdgr(ig,ib)
         if(la .eq. ma) go to 110
         cross = cross+abs(af(in,id,la)*af(in,id,ma))
  110 continue
  108 continue
  106 continue
      res = res +cross
      res =sqrt(res)
      bf(in,id,3)=bf(in,id,3)+res
  102 continue
  100 continue
      return
      end
c*********************************************************************
c     subroutine calculates by 10 % method
c_____________________________________________________________________
      subroutine tenper(nd,mnd)
c
      implicit double precision (a-h,o-z)
      common/d1/nnd,nm,imode,dofm,nnf,sfac,td,nmco
c
      common/ii1/bm(200),node(600,2),bmrz(200),bmry(200),bmrx(200)
```

```
      common/ii2/freq(25),eta(25),amp(25,3)
      common/ii3/af(600,12,25)
c
      common/c1/gud(6),bf(600,12,5)
      common/c2/ngr,mgr(25),mdgr(25,25)
      common/c3/sp1(12,3),sp2(12,1),es(12,12)
c_____________________________________________________________________________
c
      do 100 in=1,mnd
      do 102 id =1,nd
         res=0.0
         bf(in,id,4)=0.0
      do 104 im =1,imode
         res = res +af(in,id,im)*af(in,id,im)
  104 continue
      cross =0.0
      imode1=imode -1
      do 106 ia =1,imode1
      prod=0.0
      ib=ia+1
  105 cf=1.1*freq(ia)
      if(freq(ib) .le. cf)then
      axx =af(in,id,ia)*af(in,id,ib)
      prod =prod + abs(axx)
      ib=ib+1
      if(ib.gt.imode)go to 108
      go to 105
      else
      endif
  108 cross =cross+prod
  106 continue
      ayy =res +2.0*cross
      bf(in,id,4)=bf(in,id,4)+sqrt(ayy)
  102 continue
  100 continue
      return
      end
c*****************************************************************************
c      subroutine calculates by "double sum" method
c_____________________________________________________________________________
c
      subroutine dsum(nd,mnd)
      implicit double precision (a-h,o-z)
      common/d1/nnd,nm,imode,dofm,nnf,sfac,td,nmco
c
      common/ii1/bm(200),node(600,2),bmrz(200),bmry(200),bmrx(200)
```

```
      common/ii2/freq(25),eta(25),amp(25,3)
      common/ii3/af(600,12,25)
c
      common/c1/gud(6),bf(600,12,5)
      common/c2/ngr,mgr(25),mdgr(25,25)
      common/c3/sp1(12,3),sp2(12,1),es(12,12)
c_______________________________________________________________________
c
      do 10 in =1,mnd
      do 15 id =1,nd
      bf(in,id,5)=0.0
      res=0.0
      do 20 im =1,imode
      do 25 jm =1,imode
c     calculation of correlation coefficient
      fi =freq(im)*sqrt(1.0 - eta(im)**2)
      fj =freq(jm)*sqrt(1.0 - eta(jm)**2)
      ei =eta(im)+2.0/(td*freq(im))
      ej =eta(jm)+2.0/(td*freq(jm))
      corr=1.0/(1.0+((fi-fj)/(ei*freq(im)+ej*freq(jm)))**2)
         res=res +abs(af(in,id,im)*af(in,id,jm))*corr
c     write(*,30)im,jm,corr
   30 format(1x,'dsum cross(',i2,',',i2,') =',e14.6)
   25 continue
   20 continue
      bf(in,id,5)=bf(in,id,5)+sqrt(res)
   15 continue
   10 continue
      return
      end
c***********************************************************************
c
c     it performs matrix multiplication of two matrices
c
      subroutine matmu(a,b,c,ia,ja,ib,jb)
      implicit double precision (a-h,o-z)
      dimension a(ia,ja),b(ib,jb),c(ia,jb)
      do 4001 mi=1,ia
      do 4001 mj=1,jb
        c(mi,mj)=0.0
      do 4002 mk=1,ja
        aa=a(mi,mk)
        bb=b(mk,mj)
      if(aa.eq.0.0)go to 4002
        if(bb.eq.0.0)go to 4002
        c(mi,mj)=c(mi,mj)+aa*bb
```

```
 4002 continue
 4001 continue
c     write(2,4003)((c(i,j),j=1,12),i=1,12)
 4003 format(1x,/,'c',6e14.6)
      return
      end
c*************************************************************************
c                   This is for writing result disp.
c-------------------------------------------------------------------------
      subroutine dwrite(nd1,sp1,jmm)
      implicit double precision (a-h,o-z)
      dimension sp1(12,1)
c-------------------------------------------------------------------------
      if(jmm .eq.1)then
      write(3,5)nd1,(sp1(i,1),i=1,6)
    5 format(/1x,'SRSS',6x,i5,6e16.6)
      elseif(jmm .eq.2)then
      write(3,6)nd1,(sp1(i,1),i=1,6)
    6 format(1x,'CQC',7x,i5,6e16.6)
      elseif(jmm .eq.3)then
      write(3,7)nd1,(sp1(i,1),i=1,6)
    7 format(1x,'GROUPING',2x,i5,6e16.6)
      elseif(jmm .eq.4)then
      write(3,8)nd1,(sp1(i,1),i=1,6)
    8 format(1x,'10 %',6x,i5,6e16.6)
      elseif(jmm .eq.5)then
      write(3,9)nd1,(sp1(i,1),i=1,6)
    9 format(1x,'DOUBLE SUM',i5,6e16.6,/)
      else
      endif
      return
      end
```

ERRATA

Page	Misprint/Missed	To be read as
10	w	ω
11(line 4,5)	has	have
12(line 14)	of	--
14(line 15)	$\{\dot{X}\}$	$\{X\}$
15	$\overset{m}{\Sigma}\ \phi i$	$\sum_{i=1}^{m} \phi_i$
17(line13)	error	errors
17(line13)	solute	solution
18(line25)	physic	physics
19(line15)	different modes	different nodes
19(line19)	for the	by the
22	$\dot{Y}_{t+\Delta t}$ (2.3.2)	$Y_{t+\Delta t}$ (2.3.2)
23	$M\dot{Y}_{t+\Delta t}$	$M\ddot{Y}_{t+\Delta t}$
27	$l=m$	$l \neq m$
28	$k=l$	$k \neq l$
29	$\zeta_j\ \omega_i$	$\zeta_i' \omega_i$
30	$R_{ij}=R_{ik}$	$R_{ij} * R_{ik}$
39	$\{X\}+\{\ddot{U}g\}$ (3.3.1.1)	$\{\ddot{X}\}+\{\ddot{U}g\}$ (3.3.1.1)
45	$-Y_o$	$-\dot{Y}_o$
47	$\dot{Y}_j+2..$ (3.3.3.1)	$\ddot{Y}_j +..$
48	some	same
49	K=	K=1
	$l=m$	$l \neq m$
	$k=l$	$k \neq l$
50		'=' sign missing after R_i.
54	(ii)frr	(ii)fr
56	NOTE missing	NOTE :The above factors F are calculated by $F=[(-Av.Error)_{max}+1.5\sigma]_{max}$
61	world conferenceeee	symposium
65	NOTE missing	NOTE :SPACE.F is the prog. developed by the candidate for static analysis of space frame
74(bottom line)	no. of considered	no. of modes considered
113 "	"	"
132	Avarage	Average
	Average ω_n	Average σ_n
134	Avarage	Average