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Analysis of clamped skewed plates with variable thickness.

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ANALYSIS OF CLAMPED SKEWED PLATES WITH VARIABLE THICKNESS

A THESIS

Submitted to the Faculty of Graduate Studies through the Department of Civil Engineering in Partial Fullfilment of the Requirements for the Degree of Master of Applied Science at the University of Windsor

by

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ABSTRACT

A simple polynomial form in oblique dimensionless co-ordinates representing the deflection configuration of clamped skewed plates with variable thickness is used together with Galerkin's variational procedure to obtain an approximate solution to the differential equation of such plates under a uniform lateral load. Variations of centre deflections and maximum centre and edge moments and stresses with skew angle, aspect ratio and thickness coefficient are presented. An equation for a hyperbolic paraboloid surface is chosen to represent the thickness of the plate. Results are compared to those obtained by tests carried out on a plexiglas plate model, showing a fair agreement.

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CHAPTER I

INTRODUCTION

Skewed plates are often required as component parts for large scale structures, such as bridges, building floor systems, triangular dams, as well as parts of swept-back wings and fins of subsonic and supersonic aircrafts.

It was found that in a clamped skewed plate of constant thickness under a uniform lateral load the maximum moments occurred along the longer edges of the plate and were invariably displaced toward the obtuse corners; there are also high stress concentrations in the vicinity of the obtuse corners, while at the acute corners the stress concentrations were not significant.[11],[12] Accordingly, if the obtuse corners of the plate have a larger thickness than that at the acute corners the stresses in the plate will tend to be distributed more evenly, and the critical stresses and hence the mass of the plate will be reduced. Such reduction is especially important in aircraft constructions.

With reference to the theoretical work in this thesis, the Galerkin's variational procedure is used to solve the differential equation of a clamped skewed plate with variable thickness under a uniform lateral load. Following the procedure, a deflection configuration containing four undetermined parameters is first assumed satisfying not only the boundary conditions of the plate but also polar symmetry. The selected funtion is a linear combination of four independent functions. Since this function does not contain a complete

system , it does not satisfy identically the governing equation of the plate, and thus the existence of a residual load. The requirement that the total work done by such a residual load during a virtual displacement should vanish leads to the evaluation of the undetermined parameters. Accordingly, after a process of differentiation and integration the parameters are evaluated by solving a set of four simultaneous equations. Finally, the deflection equation with its determined parameters is differentiated to yeild the required moments and hence stresses. An IBM 7094 computer was used to do the computational work. To guard against round-off errors, double precision arithematic was used.

An experimental investigation of the bending behaviour of a clamped skewed plate with variable thickness was carried out on a plexiglas plate model. Strain rosette gauges and dial indicators were used to measure strains and lateral deflections, respectively. An IBM 1620 II computer was used to convert strains to stresses.

Both the computer programmes for the theoretical and experimental investigations were coded in Fortran, and are included in Appendix A.

CHAPTER II

REVIEW OF LITERATURE

Relatively little information is to be found in the literature before 1940 on the problem of skewed plates. This is due to the fact that solutions to problems of skewed, or swept structures are invariably difficult and complex. However, these solutions are of considerable importance in enabling the construction of safe and efficient structures such as skewed bridges and swept wings. In 1941, quite an entensive work was done by Jensen,[3] who investigated slabs with various skew angles, boundary conditions and loading conditions by means of finite difference equations.

Since the work of Jensen, a great deal of work has been done on skewed plates and skewed structures. The problem of uniformly loaded clamped skewed plates with constant thickness has attracted the attention of Mirsky[4] and Dorman[5] in 1950's. In 1963, limited results showing the variations of deflections and moments with skew angle were reported by Morley.[7]

In 1963, Kennedy and Martens[8] investigated experimentally the stresses near the corners of skewed stiffened plates, and they observed that critical stresses often occur in obtuse corners of such skewed plates. An analytical solution of such plates under a uniformly distributed load was presented by Kennedy and Huggins[9] in 1964.

In 1965, Kennedy[11] used Galerkin's variational procedure to investigate the bending behaviour of a clamped skewed plate under a

uniform pressure. Results showing variations of maximum deflections, centre moments and edge moments with skew angle and sides ratio were presented. In the same year, Kennedy and Ng[12] used the Rayleigh-Ritz method to solve the problem. Results obtained by the two different methods compared closely. They also observed, experimentally, the existence of high stress concentrations in the vicinity of the obtuse corners.

In 1967, Iyengar and Srinivasan[15] presented a solution for clamped parallelogrammic panels under a uniform pressure by employing characteristic functions for the modes of vibration of clamped-clamped beams. This method of solution appears to be incapable of assessing correctly the centre deflections and moments in panels with large skew angles, which influence the flexural behaviour of the panels significantly. More recently, Kennedy[14] has found a convergent solution to the problem by means of a power series and Galerkin's technique. He also examined the influence of elastic support on the centre deflections and maximum centre and edge moments in such panels and the influence of Poisson's ratio on maximum stress in such panels with non-linear behaviour.[13],[16] Kennedy and Ng[17] have also obtained a solution for linear and non-linear analyses of clamped skewed plates by employing the perturtation method.

Although a number of papers have been written on rectangular plates with variable thickness, extensive literature survey has shown that a solution to clamped skewed plates with variable thickness is not available as yet.

CHAPTER III

THEORETICAL ANALYSIS

(a) Assumptions

The usual assumptions made for the small deflcetion theory for plates of constant thickness are as follows:

(1) Deflections are small in comparison with the thickness of the plate; therefore, the membrane stresses in the middle plane of the plate are negligible.

(2) The thickness of the plate is small in comparison with its other dimensions; therefore, the normal stresses in the direction transverse to the plate can be disregarded.

(3) Points of the plate lying initially on a normal to the middle plane of the plate remain on the normal to the middle plane of the plate after bending. This assumption is equivalent to the disregard of the effect of the shear deformations on the deflection of the plate.

(4) The plate is isotropic, i.e., equal properties and behaviour of the material at each point and in all directions. All deformations are elastic.

The same assumptions are used in deriving the governing equation for plates of variable thickness, and in addition, it is assumed that there is no abrupt variation in thickness.

(b) Formulation of the Governing Equation for Plates of Variable Thickness

In deriving the equations for bending and twisting for plates of constant thickness, an element taken from the plate is considered. In the case of plates of variable thickness, if there is no abrupt variation in the thickness the difference in thickness in the element can be ignored. Thus the expressions for bending and twisting derived for plates of constant thickness can be applied to this case with sufficient accuracy.(1)

The following are the well-known expressions, relating curvatures and moments:

$$M_x = -D\left(\frac{\partial^2 W}{\partial X^2} + \nu \frac{\partial^2 W}{\partial Y^2}\right) \quad \text{(3-1)}$$

$$M_y = -D\left(\frac{\partial^2 W}{\partial Y^2} + \nu \frac{\partial^2 W}{\partial X^2}\right) \quad \text{(3-2)}$$

$$M_{xy} = D(1-\nu)\frac{\partial^2 W}{\partial X \partial Y} \quad \text{(3-3)}$$

where M_x, M_y and M_{xy} are bending and twisting moments per unit length of sections of a plate, D is the flexural rigidity of the plate, ν is the Poisson's ratio, and W is the lateral deflection.

Fig. 1 represents the middle plane of an element cut out from a plate with all the quantities shown in their positive directions. Considering the equilibrium of forces in the Z direction and moments about the X and Y axes and ignoring terms of higher order, the following three equations of equilibrium can be obtained:

$$\frac{\partial Q_x}{\partial X} + \frac{\partial Q_y}{\partial Y} + q = 0 \quad \text{(3-4)}$$

$$\frac{\partial M_x}{\partial X} - \frac{\partial M_{xy}}{\partial Y} - Q_x = 0 \quad \text{(3-5)}$$

$$\frac{\partial M_y}{\partial Y} - \frac{\partial M_{xy}}{\partial X} - Q_y = 0 \quad \text{.....(3-6)}$$

where Q_x and Q_y are shearing forces per unit length, and q is the intensity of a continuously distributed load.

Combing Eqs. (3-4), (3-5) and (3-6), yields

$$\frac{\partial^2 M_x}{\partial X^2} - 2\frac{\partial^2 M_{xy}}{\partial X \partial Y} + \frac{\partial^2 M_y}{\partial Y^2} = -q \quad \text{.....(3-7)}$$

Substituting Eqs. (3-1), (3-2) and (3-3) into Eq. (3-7) and observing that D is no longer a constant but a function of the coordinates X and Y, yields

$$D\Delta\Delta W + 2\frac{\partial D}{\partial X}\frac{\partial}{\partial X}\Delta W + 2\frac{\partial D}{\partial Y}\frac{\partial}{\partial Y}\Delta W + \Delta D \Delta W$$

$$-(1-\nu)\left(\frac{\partial^2 D}{\partial X^2}\frac{\partial^2 W}{\partial Y^2} - 2\frac{\partial^2 D}{\partial X \partial Y}\frac{\partial^2 W}{\partial X \partial Y} + \frac{\partial^2 D}{\partial Y^2}\frac{\partial^2 W}{\partial X^2}\right) = q \quad \text{.....(3-8)}$$

where $\Delta = \frac{\partial^2}{\partial X^2} + \frac{\partial^2}{\partial Y^2}$

This is the governing equation for plates with variable thickness.[1]

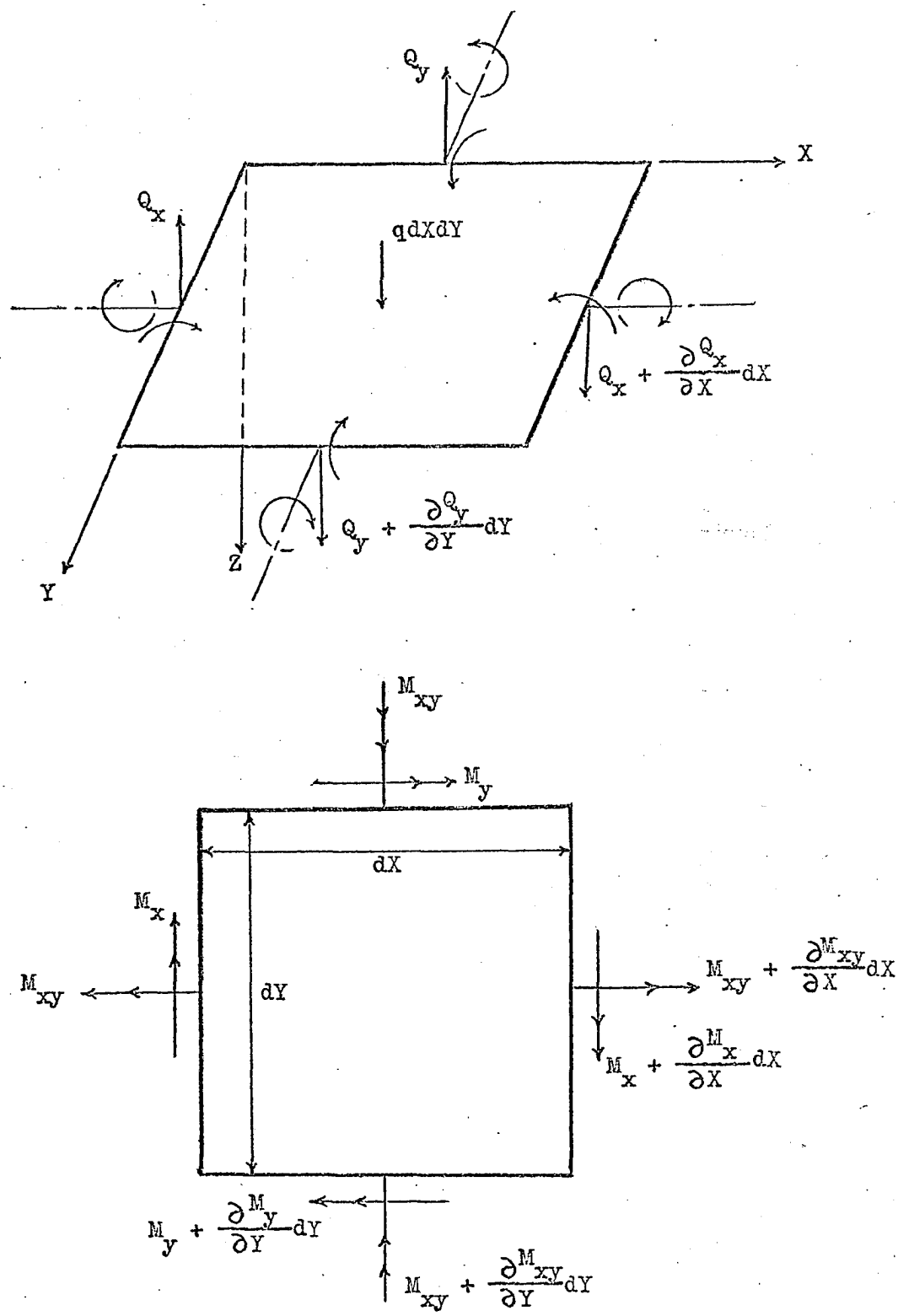


Fig. 1. Moments and Shear Forces on Plate Element with Sides dX and dY

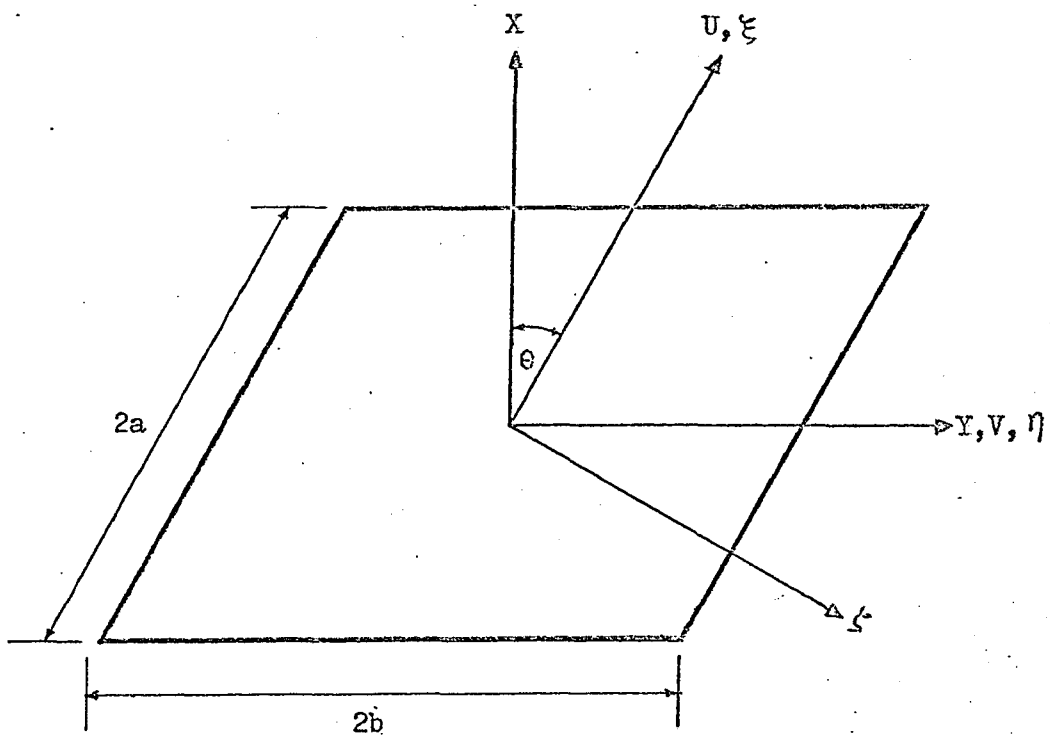


Fig. 2. Rectangular and Skewed Co-ordinate Systems

(c) The Governing Equation in Oblique Dimensionless Co-oedinates

In investigating the bending behaviour of skewed plates, it is often advantageous to adopt a co-ordinate system parallel to the edges of the plate, namely the oblique co-ordinates U and V shown in Fig. 2.

By the transformation

$$X = U\cos\theta \quad \text{.....(3-9)}$$

$$Y = V + U\sin\theta \quad \text{.....(3-10)}$$

in which θ is the skew angle, the following relationships between the rectangular and the oblique co-ordinate systems hold:

$$\frac{\partial}{\partial X} = \frac{\partial}{\partial U}\sec\theta - \frac{\partial}{\partial V}\tan\theta \quad \text{.....(3-11)}$$

$$\frac{\partial}{\partial Y} = \frac{\partial}{\partial V} \quad \text{.....(3-12)}$$

By putting

$$U = a\xi \quad \text{.....(3-13)}$$

and $$V = b\eta \quad \text{.....(3-14)}$$

in which ξ and η are dimensionless oblique co-ordinates, 2a and 2b are the oblique dimensions of the plate, Eqs. (3-11) and (3-12) can be expressed in the following dimensionless forms:

$$\frac{\partial}{\partial X} = \frac{1}{bC}\left(P\frac{\partial}{\partial \xi} - S\frac{\partial}{\partial \eta}\right) \quad \text{.....(3-15)}$$

$$\frac{\partial}{\partial Y} = \frac{1}{b}\frac{\partial}{\partial \eta} \quad \text{.....(3-16)}$$

where for brevity, $P = b/a$, $S = \sin\theta$ and $C = \cos\theta$.

Thus the following relationships can be obtained:

$$\frac{\partial^2}{\partial X^2} = \frac{1}{b^2C^2}\left(P^2\frac{\partial^2}{\partial \xi^2} - 2SP\frac{\partial^2}{\partial \eta \partial \xi} + S^2\frac{\partial^2}{\partial \eta^2}\right) \quad \text{.....(3-17)}$$

$$\frac{\partial^2}{\partial Y^2} = \frac{1}{b^2}\frac{\partial^2}{\partial \eta^2} \quad \text{.....(3-18)}$$

$$\frac{\partial^2}{\partial X \partial Y} = \frac{1}{b^2 c}\left(P\frac{\partial^2}{\partial \eta \partial \xi} - S\frac{\partial^2}{\partial \eta^2}\right) \quad \text{.....(3-19)}$$

$$\Delta = \frac{1}{b^2 c^2}\left(P^2\frac{\partial^2}{\partial \xi^2} - 2SP\frac{\partial^2}{\partial \eta \partial \xi} + \frac{\partial^2}{\partial \eta^2}\right) \quad \text{.....(3-20)}$$

$$\frac{\partial}{\partial X}\Delta = \frac{1}{b^3 c^3}\left[P^3\frac{\partial^3}{\partial \xi^3} - 3SP^2\frac{\partial^3}{\partial \eta \partial \xi^2} + (P + 2S^2P)\frac{\partial^3}{\partial \eta^2 \partial \xi} - S\frac{\partial^3}{\partial \eta^3}\right] \quad \text{.....(3-21)}$$

$$\frac{\partial}{\partial Y}\Delta = \frac{1}{b^3 c^2}\left(P^2\frac{\partial^3}{\partial \eta \partial \xi^2} - 2SP\frac{\partial^3}{\partial \eta^2 \partial \xi} + \frac{\partial^3}{\partial \eta^3}\right) \quad \text{.....(3-22)}$$

$$\Delta\Delta = \frac{1}{b^4 c^4}\left[P^4\frac{\partial^4}{\partial \xi^4} - 4SP^3\frac{\partial^4}{\partial \eta \partial \xi^3} + 2P^2(1 + 2S^2)\frac{\partial^4}{\partial \eta^2 \partial \xi^2} - 4SP\frac{\partial^4}{\partial \eta^3 \partial \xi} + \frac{\partial^4}{\partial \eta^4}\right] \quad \text{.....(3-23)}$$

Using the above transformation relationships, Eqs. (3-15) to (3-23), Eq. (3-8) can be written into oblique dimensionless form as:

$$\frac{1}{b^4 c^4} D\left[P^4\frac{\partial^4 W}{\partial \xi^4} - 4SP^3\frac{\partial^4 W}{\partial \eta \partial \xi^3} + (2P^2 + 4S^2P^2)\frac{\partial^4 W}{\partial \eta^2 \partial \xi^2} - 4SP\frac{\partial^4 W}{\partial \eta^3 \partial \xi} + \frac{\partial^4 W}{\partial \eta^4}\right] + \frac{2}{b^4 c^4}\left(P\frac{\partial D}{\partial \xi} - S\frac{\partial D}{\partial \eta}\right)\left[P^3\frac{\partial^3 W}{\partial \xi^3} - 3SP^2\frac{\partial^3 W}{\partial \eta \partial \xi^2} + (P + 2S^2P)\frac{\partial^3 W}{\partial \eta^2 \partial \xi} - S\frac{\partial^3 W}{\partial \eta^3}\right] + \frac{2}{b^4 c^2}\frac{\partial D}{\partial \eta}\left(P^2\frac{\partial^3 W}{\partial \eta \partial \xi^2} - 2SP\frac{\partial^3 W}{\partial \eta^2 \partial \xi} + \frac{\partial^3 W}{\partial \eta^3}\right) + \frac{1}{b^4 c^4}\left(P^2\frac{\partial^2 D}{\partial \xi^2} - 2SP\frac{\partial^2 D}{\partial \eta \partial \xi} + \frac{\partial^2 D}{\partial \eta^2}\right)\left(P^2\frac{\partial^2 W}{\partial \xi^2} - 2SP\frac{\partial^2 W}{\partial \eta \partial \xi} +\right.$$

$$\frac{\partial^2 W}{\partial \eta^2}) - (1 - \nu) \frac{1}{b^4 c^2} \left[(P^2 \frac{\partial^2 D}{\partial \xi^2} - 2SP \frac{\partial^2 D}{\partial \eta \partial \xi} + S^2 \frac{\partial^2 D}{\partial \eta^2}) \frac{\partial^2 W}{\partial \eta^2} \right.$$

$$- 2(P \frac{\partial^2 D}{\partial \eta \partial \xi} - S \frac{\partial^2 D}{\partial \eta^2})(P \frac{\partial^2 W}{\partial \eta \partial \xi} - S \frac{\partial^2 W}{\partial \eta^2}) + \frac{\partial^2 D}{\partial \eta^2}(P^2 \frac{\partial^2 W}{\partial \xi^2}$$

$$\left. - 2SP \frac{\partial^2 W}{\partial \eta \partial \xi} + S^2 \frac{\partial^2 W}{\partial \eta^2}) \right] = q \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (3\text{-}24)$$

(d) Assumed Variations in the Plate Thickness and Flexural Rigidity

The mathematical expression for the thickness of the plate at any point is chosen as:

$$h = h_o(1 - K\eta\xi) \quad \text{.....(3-25)}$$

where h_o is the thickness at the centre of the plate, and K is an adjustable positive constant less than one. K is inserted, so that the thickness at the acute corners will not be zero. When K is zero, the thickness will be constant throughout the plate. Eq. (3-25) is an equation for a hyperbolic paraboloid surface. Thus one surface of the plate has the shape of a hyperbolic paraboloid, and the opposite surface is flat. The surface of a hyperbolic paraboloid can be easily generated by moving a straight line parallel to one of the two horizontal axes of the plate on two other straight lines which are inclined to each other but parallel to the other horizontal axis. Hence, the thickness equation not only enables one to attain the objective of increasing the thickness at the obtuse corners of the plate or slab but also yields a surface which has the practical advantage of relatively easy forming. Moreover, by adjusting the coefficient K in the equation one can attain various ratios of plate thickness at the obtuse corner to that at the acute corner.

With the thickness as given by Eq. (3-25), the flexural rigidity of the plate at any point becomes:

$$D = \frac{Eh^3}{12(1 - \nu^2)} = D_o(1 - K\eta\xi)^3 \quad \text{.....(3-26)}$$

where D_o is the flexural rigidity at the centre of the plate.

(e) The Galerkin's Procedure

To apply the Galerkin's procedure, a deflcetion configuration for a clamped skewed plate is assumed as:

$$W = (1-\eta^2)^2(1-\xi^2)^2(1-\eta\xi)(C_0+C_1\eta^2+C_2\xi^2+C_3\eta^2\xi^2) \quad \text{.....(3-27)}$$

where C_0, C_1, C_2, and C_3 are undetermined parameters.

The boundary conditions for the clamped plate are:

$$\left.\begin{aligned} W &= 0 \\ \frac{\partial W}{\partial \zeta} &= 0 \end{aligned}\right\} \text{ at } V = \pm b \text{ or } \eta = \pm 1$$

and

$$\left.\begin{aligned} W &= 0 \\ \frac{\partial W}{\partial X} &= 0 \end{aligned}\right\} \text{ at } U = \pm a \text{ or } \xi = \pm 1$$

where ζ is in a direction normal to the edge of the plate (Fig. 2).

From Eq. (3-27), it can be readily shown that all these boundary conditions are identically satisfied. It may be worth noting also that the deflection function chosen satisfies the polar symmetry, i.e., $W(\xi,\eta) = W(-\xi,-\eta)$ and $W(-\xi,\eta) = W(\xi,-\eta)$, which is a necessary condition for a uniformly loaded skewed plate.

Substituting Eqs. (3-26) and (3-27) into Eq. (3-24), the governing equation can be written in the following form:

$$g(\xi,\eta) - q/D_0 = 0 \quad \text{.....(3-28)}$$

Since Eq. (3-27) is only an approximate solution to Eq. (3-24), it is clear that Eq. (3-28) is an error function, which can be considered as a residual load. The tatol work done by such a residual load during a virtual displacement corresponding to an increment δW is identically zero.[2],[13] Thus mathematically expressed:

$$\iint_R \text{Eq.}(3\text{-}28)\, \delta W d\eta d\xi = 0 \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (3\text{-}29)$$

where the double integral extends over the plate region R.

From Eq. (3-29) and by using Eq. (3-27), Galerkin's procedure requires

$$\int_{-1}^{+1}\int_{-1}^{+1} \text{Eq.}(3\text{-}28)\, \frac{\partial W}{\partial c_i}\, d\eta d\xi = 0 \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (3\text{-}30)$$

where $i = 0, 1, 2$ and 3.

Performing the integration indicated in Eq. (3-30) yields, after some cumbersome algebra, four simultaneous equations, from which the four parameters can be obtained. These parameters are then inserted into the expression for the deflection, Eq. (3-27), from which deflections at any point within the plate boundaries can be determined.

A programme coded in Fortran for an IBM 7094 computer was used to solve for the unknown parameters.

(f) Moment and Displacement Relationship

It was indicated that the expressions for bending and twisting moments derived for plates of constant thickness could be applied with sufficient accuracy to plates of variable thickness provided that there was no abrupt variation in thickness.

Using the transformation relationships, Eqs. (3-17), (3-18) and (3-19), rectangular moments can be expressed in terms of the deflection W in oblique dimensionless co-ordinates, ξ and η. Thus:

$$M_x = -D\left(\frac{\partial^2 W}{\partial X^2} + \nu \frac{\partial^2 W}{\partial Y^2}\right)$$

$$= \frac{D_o(K\eta\xi - 1)^3}{b^2 C^2}\left[P^2 \frac{\partial^2 W}{\partial \xi^2} - 2SP \frac{\partial^2 W}{\partial \eta \partial \xi} + (S^2 + \nu C^2) \frac{\partial^2 W}{\partial \eta^2}\right] \quad \text{.....(3-31)}$$

$$M_y = -D\left(\frac{\partial^2 W}{\partial Y^2} + \nu \frac{\partial^2 W}{\partial X^2}\right)$$

$$= \frac{D_o(K\eta\xi - 1)^3}{b^2 C^2}\left[\nu P^2 \frac{\partial^2 W}{\partial \xi^2} - 2\nu SP \frac{\partial^2 W}{\partial \eta \partial \xi} + (\nu S^2 + C^2) \frac{\partial^2 W}{\partial \eta^2}\right] \quad \text{.....(3-32)}$$

$$M_{xy} = D(1 - \nu) \frac{\partial^2 W}{\partial X \partial Y}$$

$$= \frac{D_o(\nu - 1)(K\eta\xi - 1)^3}{b^2 C}\left(P \frac{\partial^2 W}{\partial \eta \partial \xi} - S \frac{\partial^2 W}{\partial \eta^2}\right) \quad \text{.....(3-33)}$$

From the rectangular moments M_x, M_y and the twisting moment M_{xy}, the principal moments, M_{max} and M_{min}, can be calculated in the usual manner:

$$M_{max} = \frac{1}{2}(M_x + M_y) + \frac{1}{2}\sqrt{(M_x - M_y)^2 + 4M_{xy}} \quad \text{.....(3-34)}$$

$$M_{min} = \frac{1}{2}(M_x + M_y) - \frac{1}{2}\sqrt{(M_x - M_y)^2 + 4M_{xy}} \quad \text{.....(3-35)}$$

The direction in which the maximum principal stress occurs is

$$\phi = \frac{1}{2} \tan^{-1} \frac{2M_{xy}}{(M_x - M_y)} \quad \text{.....(3-36)}$$

where ϕ is the angle mearsured clockwise from the X direction.

Once these moments are known, the stresses can be readily obtained by multiplying the corresponding moments by $6/h^2$, i.e.,

$$\sigma_x = \frac{6M_x}{h^2} = \frac{6M_x}{h_o^2(1 - K\eta\xi)^2} \quad \text{.....(3-37)}$$

$$\sigma_y = \frac{6M_y}{h^2} = \frac{6M_y}{h_o^2(1 - K\eta\xi)^2} \quad \text{.....(3-38)}$$

$$\tau_{xy} = \frac{6M_{xy}}{h^2} = \frac{6M_{xy}}{h_o^2(1 - K\eta\xi)^2} \quad \text{.....(3-39)}$$

$$\sigma_{max} = \frac{6M_{max}}{h^2} = \frac{6M_{max}}{h_o^2(1 - K\eta\xi)^2} \quad \text{.....(3-40)}$$

and

$$\sigma_{min} = \frac{6M_{min}}{h^2} = \frac{6M_{min}}{h_o^2(1 - K\eta\xi)^2} \quad \text{.....(3-41)}$$

(g) Observation and Discussion of Theoretical Results

Theoretical results for centre deflections, maximum moments and stresses at centre and along the edge for various skew angles, aspect ratios and thickness coefficients are shown in TABLE I. It can be observed that the deflection coefficient W_1 and stress coefficients S_1 and S_2 invariably decrease with increasing K, the thickness coefficient. Observing the thickness equation, it can be seen that by increasing K the thickness at the obtuse corners of the plate is increased while that at the acute corners is decreased. Hence, the objective of reducing the critical stresses and the centre deflection of the plate by increasing the thickness at the obtuse corners relative to that at the acute corners is attained. Furthermore, the ratio of the coefficient of the maximum edge stress S_2 to the coefficient of the maximum centre stress S_1 invariably decreases with increasing K. This means that the stresses in the plate tend to distribute more evenly with the assumed variation in thickness.

It is also to be noted that the volume and hence the mass of the plate are decreased, as shown in TABLE II.

The percentage differences in the values of W_1, S_2, L (the volume coefficient) and S_2/S_1 when K = 0 and K = 0.8 for various skew angles and aspect ratios are shown in Figs. 3, 4, 5 and 6, respectively. The average differences are, respectively, 25%, 27%, 15% and 16%.

It can be also observed that points of maximum stress and maximum moment along the longer edge do not coincide, generally, with the latter being closer to the obtuse corner.

Furthermore, the tabular results show that the centre deflections, moments and stresses at centre and along the edge decrease with increasing skew and aspect ratio.

(h) Convergency of Results

The convergency of the theoretical solution was checked by comparing the results obtained from one-, two-, three- and four-parameter solutions. A sample of the results are presented in TABLE III where centre deflections, principal centre and edge moments, obtained from the four solutions, are compared. For the maximum moments along the longer edge where critical stresses may occur the percentage differences between the results from three- and four-parameter solutions are less than 1%. As for the centre deflections and maximum moments the convergency of the results is not as favourable; however, the results from the four-parameter solution appear to be conservative. TABLE IV gives a comparison of centre deflections and maximum moments at centre and edge for clamped skewed plates of constant thickness with Kennedy's results obtained from thirty-six-parameter solution.[14] It can be seen that the results from the two solutions compare quite closely.

TABLE I

Coefficients for Centre Deflections, Max. Moments and Stresses at Centre and Edge for Various Skew Angles (θ), Aspect Ratios (P) and Thickness Coefficients (K)

(Deflection = $W_1(b^4q/D_o)(10)^{-4}$, Moment = $M_i b^2 q(10)^{-2}$, Stress = $S_i(b/h_o)^2 q(10)^{-2}$)

(A) $\theta = 15^\circ$

P	K	CENTRE			$\xi = 1$						$\frac{\lvert S_2 \rvert}{S_1}$
		W_1	M_1	S_1	$-M_2$	$-S_2$ #	$-\eta_2$	$-M_3$ ##	$-S_3$	$-\eta_3$	
1.00	0	180.9	8.894	53.37	19.95	119.7	0.3	19.95	119.7	0.3	2.24
	0.2	171.7	8.637	51.82	21.16	113.0	0.3	21.32	109.7	0.4	2.18
	0.4	161.8	8.396	50.37	22.00	105.2	0.3	22.97	102.4	0.4	2.09
	0.5	156.8	8.262	49.57	22.29	101.1	0.3	23.65	98.55	0.4	2.04
	0.6	151.7	8.121	48.73	22.51	96.98	0.3	24.25	94.63	0.4	1.99
	0.7	146.6	7.975	47.85	22.65	92.81	0.3	25.04	82.42	0.5	1.94
	0.8	141.6	7.824	46.94	22.72	88.67	0.3	25.77	78.88	0.5	1.89
1.25	0	106.5	7.750	46.50	16.98	101.9	0.3	16.98	101.9	0.3	2.19
	0.2	101.2	7.526	45.16	18.07	96.51	0.3	18.41	94.70	0.4	2.14
	0.4	95.44	7.267	43.60	18.88	90.30	0.3	19.87	88.62	0.4	2.07
	0.5	92.51	7.129	42.77	19.18	87.03	0.3	20.50	85.42	0.4	2.03
	0.6	89.57	6.987	41.92	19.43	83.71	0.3	21.20	75.26	0.5	2.00
	0.7	86.64	6.841	41.05	19.61	80.38	0.3	21.93	72.18	0.5	1.96
	0.8	83.73	6.694	40.17	19.75	77.06	0.3	22.59	69.17	0.5	1.92

#: Coefficients for Max. Stresses at edge.

##: Coefficients for Max. Moments at edge.

Poisson's ratio $\nu = 0.3$

$i = 1, 2, 3$

TABLE I (Cont'd.)

(A) $\theta = 15^{\circ}$

P	K	CENTRE			$\xi = 1$						$\frac{\lvert S_2 \rvert}{S_1}$
		W_1	M_1	S_1	$-M_2$	$-S_2$	$-\eta_2$	$-M_3$	$-S_3$	$-\eta_3$	
1.50	0	61.58	6.264	37.58	13.73	82.39	0.3	13.73	82.39	0.3	2.19
	0.2	58.65	6.081	36.48	14.64	78.19	0.3	15.07	77.52	0.4	2.14
	0.4	55.50	5.873	35.24	15.35	73.40	0.3	16.26	72.50	0.4	2.08
	0.5	53.88	5.764	34.58	15.62	70.89	0.3	16.80	64.52	0.5	2.05
	0.6	52.26	5.652	33.91	15.86	68.35	0.3	17.43	61.89	0.5	2.02
	0.7	50.64	5.538	33.23	16.06	65.80	0.3	18.02	59.31	0.5	1.98
	0.8	49.03	5.422	32.53	16.21	63.26	0.3	18.56	56.82	0.5	1.94
1.75	0	36.36	4.938	29.63	11.07	66.41	0.4	11.07	66.41	0.4	2.24
	0.2	34.74	4.800	28.80	12.17	62.63	0.4	11.92	59.12	0.5	2.17
	0.4	33.00	4.645	27.87	12.30	58.85	0.3	13.11	58.48	0.4	2.11
	0.5	32.10	4.564	27.38	12.55	56.94	0.3	13.62	52.28	0.5	2.08
	0.6	31.20	4.481	26.89	12.76	55.00	0.3	14.10	50.06	0.5	2.05
	0.7	30.30	4.397	26.38	12.95	53.07	0.3	14.55	47.92	0.5	2.01
	0.8	29.40	4.312	25.87	13.11	51.14	0.3	14.98	45.86	0.5	1.98
2.00	0	22.21	3.891	23.35	9.019	54.11	0.4	9.019	54.11	0.4	2.32
	0.2	21.31	3.790	22.74	9.883	50.84	0.4	9.883	50.84	0.4	2.24
	0.4	20.33	3.679	22.07	9.913	47.42	0.3	10.67	44.48	0.5	2.15
	0.5	19.82	3.621	21.73	10.12	45.94	0.3	11.07	42.52	0.5	2.11
	0.6	19.31	3.562	21.37	10.32	44.45	0.3	11.45	40.64	0.5	2.08
	0.7	18.79	3.501	21.01	10.48	42.97	0.3	11.80	38.83	0.5	2.05
	0.8	18.28	3.440	20.64	10.63	41.50	0.3	12.13	37.12	0.5	2.01

TABLE I (Cont'd.)

(B) $\theta = 30^\circ$

P	K	CENTRE			$\xi = 1$						$\frac{\lvert S_2 \rvert}{S_1}$
		W_1	M_1	S_1	$-M_2$	$-S_2$	$-\eta_2$	$-M_3$	$-S_3$	$-\eta_3$	
1.00	0	121.0	8.208	49.25	16.45	98.71	0.3	16.45	98.71	0.3	2.00
	0.2	113.6	8.018	48.11	18.05	92.83	0.4	18.05	92.83	0.4	1.93
	0.4	105.8	7.762	46.57	19.24	85.78	0.4	19.88	82.84	0.5	1.84
	0.5	101.9	7.616	45.70	19.69	82.05	0.4	20.73	79.59	0.5	1.80
	0.6	97.98	7.462	44.77	20.06	78.29	0.4	21.48	76.26	0.5	1.75
	0.7	94.17	7.301	43.81	20.35	74.54	0.4	22.15	72.92	0.5	1.70
	0.8	90.44	7.135	42.81	20.58	70.86	0.4	22.86	62.61	0.6	1.66
1.25	0	71.27	6.569	39.41	14.14	84.81	0.4	14.14	84.81	0.4	2.15
	0.2	66.99	6.395	38.37	15.52	79.86	0.4	15.64	77.54	0.5	2.08
	0.4	62.49	6.175	37.05	16.58	73.93	0.4	17.36	72.33	0.5	2.00
	0.5	60.22	6.052	36.31	17.00	70.82	0.4	18.10	69.52	0.5	1.95
	0.6	57.98	5.924	35.54	17.35	67.69	0.4	18.77	66.65	0.5	1.90
	0.7	55.77	5.791	34.75	17.64	64.59	0.4	19.40	57.72	0.6	1.86
	0.8	53.61	5.656	33.94	17.87	61.54	0.4	20.19	55.32	0.6	1.81
1.50	0	41.33	5.227	31.36	11.55	69.30	0.4	11.55	69.30	0.4	2.21
	0.2	38.96	5.080	30.48	12.66	65.10	0.4	12.88	63.89	0.5	2.14
	0.4	36.46	4.900	29.40	13.51	60.26	0.4	14.24	59.35	0.5	2.05
	0.5	35.20	4.802	28.81	13.86	57.76	0.4	14.83	56.97	0.5	2.00
	0.6	33.96	4.700	28.20	14.16	55.26	0.4	15.37	54.57	0.5	1.96
	0.7	32.73	4.595	27.57	14.42	52.80	0.4	15.90	47.30	0.6	1.91
	0.8	31.52	4.489	26.93	14.63	50.39	0.4	16.52	45.25	0.6	1.87

TABLE I (Cont'd.)

(B) $\theta = 30^{0}$

P	K	CNETRE			$\xi = 1$						$\frac{\lvert S_2 \rvert}{S_1}$
		W_1	M_1	S_1	$-M_2$	$-S_2$	$-\eta_2$	$-M_3$	$-S_3$	$-\eta_3$	
1.75	0	24.46	4.114	24.69	9.324	55.94	0.4	9.324	55.94	0.4	2.27
	0.2	23.15	4.000	24.00	10.18	52.38	0.4	10.45	51.82	0.5	2.18
	0.4	21.76	3.863	23.18	10.86	48.43	0.4	11.49	47.88	0.5	2.09
	0.5	21.06	3.789	22.73	11.14	46.43	0.4	11.95	45.87	0.5	2.04
	0.6	20.36	3.712	22.27	11.39	44.46	0.4	12.36	43.88	0.5	2.00
	0.7	19.67	3.633	21.80	11.61	42.52	0.4	12.74	41.94	0.5	1.95
	0.8	18.99	3.554	21.32	11.80	40.64	0.4	13.20	36.17	0.6	1.91
2.00	0	14.98	3.248	19.49	7.564	45.39	0.4	7.564	45.39	0.4	2.33
	0.2	14.24	3.163	18.98	8.234	42.35	0.4	8.506	42.18	0.5	2.23
	0.4	13.45	3.062	18.37	8.771	39.11	0.4	9.300	38.75	0.5	2.13
	0.5	13.04	3.007	18.04	8.999	37.50	0.4	9.647	37.05	0.5	2.08
	0.6	12.64	2.951	17.71	9.204	35.92	0.4	9.966	35.38	0.5	2.03
	0.7	12.25	2.893	17.36	9.389	34.38	0.4	10.26	33.78	0.5	1.98
	0.8	11.85	2.834	17.01	9.554	32.90	0.4	10.56	28.93	0.6	1.93

TABLE I (Cont'd.)

(c) $\theta = 45^\circ$

P	K	CENTRE			$\xi = 1$						$\frac{\lvert S_2 \rvert}{S_1}$
		W_1	M_1	S_1	$-M_2$	$-S_2$	$-\eta_2$	$-M_3$	$-S_3$	$-\eta_3$	
1.00	0	52.70	5.720	34.32	11.14	66.83	0.4	11.14	66.83	0.4	1.95
	0.2	49.15	5.596	33.57	12.17	62.58	0.4	12.37	61.34	0.5	1.86
	0.4	45.45	5.413	32.48	12.88	57.44	0.4	13.72	57.17	0.5	1.77
	0.5	43.61	5.306	31.84	14.29	54.86	0.5	14.29	54.86	0.5	1.72
	0.6	41.80	5.191	31.15	14.78	52.49	0.5	14.96	48.52	0.6	1.69
	0.7	40.03	5.071	30.43	15.22	50.10	0.5	15.66	46.60	0.6	1.65
	0.8	38.31	4.947	29.68	15.59	47.74	0.5	16.30	44.66	0.6	1.61
1.25	0	31.20	4.473	26.84	9.555	57.33	0.4	9.555	57.33	0.4	2.14
	0.2	29.13	4.370	26.22	10.44	53.69	0.4	10.81	53.60	0.5	2.05
	0.4	26.98	4.223	25.34	11.99	49.94	0.5	11.99	49.94	0.5	1.97
	0.5	25.91	4.139	24.83	12.48	47.93	0.5	12.59	44.69	0.6	1.93
	0.6	24.85	4.048	24.29	12.92	45.89	0.5	13.26	43.01	0.6	1.89
	0.7	23.82	3.954	23.73	13.32	43.84	0.5	13.88	41.30	0.6	1.85
	0.8	22.82	3.857	23.14	13.66	41.82	0.5	14.45	39.59	0.6	1.81
1.50	0	18.26	3.505	21.03	7.821	46.92	0.4	7.821	46.92	0.4	2.23
	0.2	17.10	3.420	20.52	8.935	44.31	0.5	8.935	44.31	0.5	2.16
	0.4	15.89	3.303	19.82	9.870	41.12	0.5	9.870	41.12	0.5	2.08
	0.5	15.28	3.236	19.42	10.27	39.43	0.5	10.42	37.00	0.6	2.03
	0.6	14.69	3.166	19.00	10.62	37.72	0.5	10.95	35.53	0.6	1.99
	0.7	14.10	3.094	18.56	10.94	36.02	0.5	11.45	34.06	0.6	1.94
	0.8	13.54	3.019	18.11	11.23	34.36	0.5	11.90	32.61	0.6	1.90

TABLE I (Cont'd.)

(C) $\theta = 45^{\circ}$

P	K	CENTRE			$\xi = 1$						$\frac{\lvert S_2 \rvert}{S_1}$
		W_1	M_1	S_1	$-M_2$	$-S_2$	$-\eta_2$	$-M_3$	$-S_3$	$-\eta_3$	
1.75	0	10.91	2.755	16.53	6.388	38.33	0.5	6.388	38.33	0.5	2.32
	0.2	10.26	2.687	16.12	7.266	36.03	0.5	7.266	36.03	0.5	2.24
	0.4	9.570	2.596	15.58	7.986	33.28	0.5	8.000	31.22	0.6	2.14
	0.5	9.227	2.546	15.27	8.294	31.85	0.5	8.436	29.95	0.6	2.09
	0.6	8.887	2.492	14.95	8.572	30.43	0.5	8.840	28.68	0.6	2.03
	0.7	8.555	2.437	14.62	8.822	29.04	0.5	9.216	27.42	0.6	1.99
	0.8	8.230	2.381	14.29	9.048	27.70	0.5	9.566	26.20	0.6	1.94
2.00	0	6.740	2.184	13.10	5.239	31.44	0.5	5.239	31.44	0.5	2.40
	0.2	6.360	2.131	12.79	5.917	29.34	0.5	5.917	29.34	0.5	2.29
	0.4	5.962	2.063	12.38	6.470	26.96	0.5	6.489	25.32	0.6	2.18
	0.5	5.762	2.024	12.15	6.708	25.76	0.5	6.819	24.21	0.6	2.12
	0.6	5.564	1.984	11.91	6.924	24.58	0.5	7.124	23.11	0.6	2.06
	0.7	5.369	1.943	11.66	7.121	23.44	0.5	7.407	22.04	0.6	2.01
	0.8	5.179	1.900	11.40	7.300	22.35	0.5	7.672	21.01	0.6	1.96

TABLE I (Cont'd.)

(D) $\theta = 60^{\circ}$

P	K	CENTRE			$\xi = 1$						$\frac{\lvert S_2 \rvert}{S_1}$
		W_1	M_1	S_1	$-M_2$	$-S_2$	$-\eta_2$	$-M_3$	$-S_3$	$-\eta_3$	
1.00	0	12.59	2.822	16.93	5.507	33.04	0.4	5.507	33.04	0.4	1.95
	0.2	11.70	2.768	16.61	5.995	30.84	0.4	6.160	30.55	0.5	1.86
	0.4	10.78	2.680	16.08	6.821	28.42	0.5	6.821	28.42	0.5	1.77
	0.5	10.32	2.627	15.76	7.093	27.24	0.5	7.143	25.36	0.6	1.73
	0.6	9.870	2.570	15.42	7.331	26.03	0.5	7.524	24.41	0.6	1.69
	0.7	9.433	2.509	15.06	7.536	24.81	0.5	7.874	23.43	0.6	1.65
	0.8	9.009	2.446	14.68	7.711	23.61	0.5	8.194	22.45	0.6	1.61
1.25	0	7.496	2.198	13.19	4.721	28.33	0.4	4.721	28.33	0.4	2.15
	0.2	6.973	2.154	12.93	5.391	26.73	0.5	5.391	26.73	0.5	2.07
	0.4	6.431	2.085	12.51	5.966	24.86	0.5	5.991	23.38	0.6	1.99
	0.5	6.163	2.044	12.26	6.206	23.83	0.5	6.356	22.57	0.6	1.94
	0.6	5.899	2.000	12.00	6.417	22.78	0.5	6.693	21.71	0.6	1.90
	0.7	5.642	1.952	11.71	6.601	21.73	0.5	7.005	20.84	0.6	1.86
	0.8	5.393	1.904	11.42	6.762	20.70	0.5	7.292	19.97	0.6	1.81
1.50	0	4.438	1.719	10.32	3.916	23.49	0.5	3.916	23.49	0.5	2.28
	0.2	4.138	1.683	10.10	4.485	22.24	0.5	4.485	22.24	0.5	2.20
	0.4	3.828	1.629	9.773	4.946	20.61	0.5	5.017	19.58	0.6	2.11
	0.5	3.674	1.597	9.580	5.139	19.73	0.5	5.311	18.85	0.6	2.06
	0.6	3.523	1.562	9.374	5.311	18.85	0.5	5.582	18.11	0.6	2.01
	0.7	3.375	1.526	9.157	5.462	17.98	0.5	5.833	17.36	0.6	1.96
	0.8	3.232	1.489	8.932	5.595	17.13	0.5	6.066	16.62	0.6	1.92

TABLE I (Cont'd.)

(D) $\theta = 60^\circ$

P	K	CENTRE			$\xi = 1$						$\frac{\lvert S_2 \rvert}{S_1}$
		W_1	M_1	S_1	$-M_2$	$-S_2$	$-\eta_2$	$-M_3$	$-S_3$	$-\eta_3$	
1.75	0	2.683	1.356	8.134	3.226	19.36	0.5	3.226	19.36	0.5	2.38
	0.2	2.510	1.327	7.959	3.670	18.20	0.5	3.670	18.20	0.5	2.29
	0.4	2.331	1.284	7.704	4.030	16.79	0.5	4.109	16.03	0.6	2.18
	0.5	2.242	1.259	7.555	4.181	16.06	0.5	4.336	15.39	0.6	2.13
	0.6	2.154	1.233	7.396	4.316	15.32	0.5	4.546	14.75	0.6	2.07
	0.7	2.069	1.205	7.231	4.437	14.61	0.5	4.741	14.11	0.6	2.02
	0.8	1.985	1.177	7.060	4.545	13.91	0.5	4.922	13.48	0.6	1.97
2.00	0	1.673	1.081	6.485	2.657	15.94	0.5	2.657	15.94	0.5	2.46
	0.2	1.571	1.058	6.346	3.003	14.89	0.5	3.003	14.89	0.5	2.35
	0.4	1.466	1.025	6.148	3.282	13.67	0.5	3.352	13.08	0.6	2.22
	0.5	1.413	1.006	6.034	3.400	13.06	0.5	3.527	12.52	0.6	2.16
	0.6	1.361	0.9854	5.913	3.507	12.45	0.5	3.688	11.96	0.6	2.11
	0.7	1.310	0.9643	5.786	3.602	11.86	0.5	3.838	11.42	0.6	2.05
	0.8	1.261	0.9426	5.655	3.689	11.29	0.5	3.977	10.89	0.6	2.00

TABLE I (Cont'd.)

(E) $\theta = 75^\circ$

P	K	CENTRE			$\xi = 1$						$\left\|\frac{S_2}{S_1}\right\|$
		W_1	M_1	S_1	$-M_2$	$-S_2$	$-\eta_2$	$-M_3$	$-S_3$	$-\eta_3$	
1.00	0	0.8680	0.7363	4.418	1.451	8.706	0.4	1.451	8.706	0.4	1.97
	0.2	0.8052	0.7237	4.342	1.576	8.107	0.4	1.626	8.062	0.5	1.87
	0.4	0.7403	0.7017	4.210	1.797	7.489	0.5	1.797	7.489	0.5	1.78
	0.5	0.7081	0.6881	4.128	1.868	7.172	0.5	1.890	6.710	0.6	1.74
	0.6	0.6766	0.6732	4.039	1.929	6.847	0.5	1.990	6.455	0.6	1.70
	0.7	0.6460	0.6573	3.944	1.981	6.522	0.5	2.081	6.193	0.6	1.65
	0.8	0.6164	0.6408	3.845	2.025	6.200	0.5	2.165	5.930	0.6	1.61
1.25	0	0.5191	0.5738	3.443	1.244	7.465	0.4	1.244	7.465	0.4	2.17
	0.2	0.4819	0.5637	3.382	1.425	7.064	0.5	1.425	7.064	0.5	2.09
	0.4	0.4436	0.5464	3.279	1.574	6.559	0.5	1.590	6.204	0.6	2.00
	0.5	0.4246	0.5358	3.215	1.636	6.283	0.5	1.686	5.987	0.6	1.95
	0.6	0.4060	0.5243	3.146	1.690	6.001	0.5	1.775	5.758	0.6	1.91
	0.7	0.3879	0.5120	3.072	1.737	5.719	0.5	1.857	5.525	0.6	1.86
	0.8	0.3704	0.4992	2.995	1.778	5.443	0.5	1.932	5.292	0.6	1.82
1.50	0	0.3099	0.4500	2.700	1.041	6.247	0.5	1.041	6.247	0.5	2.31
	0.2	0.2884	0.4416	2.650	1.191	5.908	0.5	1.191	5.908	0.5	2.23
	0.4	0.2661	0.4280	2.568	1.312	5.468	0.5	1.341	5.232	0.6	2.13
	0.5	0.2551	0.4197	2.518	1.362	5.232	0.5	1.419	5.037	0.6	2.08
	0.6	0.2443	0.4108	2.465	1.407	4.994	0.5	1.491	4.837	0.6	2.03
	0.7	0.2338	0.4013	2.408	1.446	4.759	0.5	1.558	4.635	0.6	1.98
	0.8	0.2236	0.3914	2.349	1.480	4.529	0.5	1.619	4.435	0.6	1.93

TABLE I (Cont'd.)

(E) $\theta = 75^\circ$

P	K	CENTRE			$\xi = 1$						$\frac{\lvert S_2 \rvert}{S_1}$
		W_1	M_1	S_1	$-M_2$	$-S_2$	$-\eta_2$	$-M_3$	$-S_3$	$-\eta_3$	
1.75	0	0.1889	0.3564	2.138	0.8622	5.173	0.5	0.8622	5.173	0.5	2.42
	0.2	0.1764	0.3495	2.097	0.9805	4.862	0.5	0.9805	4.862	0.5	2.32
	0.4	0.1634	0.3388	2.033	1.075	4.481	0.5	1.105	4.314	0.6	2.20
	0.5	0.1569	0.3323	1.994	1.115	4.282	0.5	1.167	4.142	0.6	2.15
	0.6	0.1506	0.3254	1.952	1.150	4.084	0.5	1.223	3.969	0.6	2.09
	0.7	0.1444	0.3181	1.909	1.182	3.890	0.5	1.276	3.796	0.6	2.04
	0.8	0.1384	0.3105	1.863	1.209	3.702	0.5	1.324	3.628	0.6	1.99
2.00	0	0.1187	0.2856	1.714	0.7128	4.277	0.5	0.7128	4.277	0.5	2.50
	0.2	0.1112	0.2800	1.680	0.8057	3.995	0.5	0.8057	3.995	0.5	2.38
	0.4	0.1035	0.2716	1.629	0.8802	3.667	0.5	0.9068	3.539	0.6	2.25
	0.5	0.09960	0.2666	1.599	0.9115	3.500	0.5	0.9545	3.389	0.6	2.19
	0.6	0.09580	0.2612	1.567	0.9394	3.335	0.5	0.9985	3.239	0.6	2.13
	0.7	0.09209	0.2556	1.533	0.9644	3.175	0.5	1.039	3.092	0.6	2.07
	0.8	0.08847	0.2497	1.498	0.9868	3.021	0.5	1.077	2.950	0.6	2.02

TABLE II

Variation of Volume Coefficient L with Skew Angle,

Aspect Ratio and Thickness Coefficient

(Volume = $L(q/f)^{\frac{1}{2}}a^3$)

P	K	$\theta = 15^\circ$	$\theta = 30^\circ$	$\theta = 45^\circ$	$\theta = 60^\circ$	$\theta = 75^\circ$
	0	4.227	3.442	2.312	1.150	0.3055
	0.2	4.107	3.338	2.238	1.111	0.2948
	0.4	3.964	3.208	2.144	1.066	0.2833
1.00	0.5	3.886	3.138	2.095	1.044	0.2773
	0.6	3.805	3.065	2.049	1.020	0.2709
	0.7	3.722	2.991	2.002	0.9962	0.2644
	0.8	3.638	2.916	1.954	0.9717	0.2578
	0	6.093	4.985	3.346	1.663	0.4420
	0.2	5.931	4.837	3.238	1.616	0.4299
	0.4	5.737	4.654	3.123	1.558	0.4143
1.25	0.5	5.632	4.555	3.060	1.525	0.4055
	0.6	5.524	4.453	2.994	1.492	0.3963
	0.7	5.412	4.350	2.926	1.457	0.3869
	0.8	5.299	4.246	2.858	1.422	0.3774
	0	7.891	6.488	4.359	2.181	0.5822
	0.2	7.687	6.289	4.236	2.122	0.5662
	0.4	7.448	6.050	4.081	2.043	0.5447
1.50	0.5	7.319	5.923	3.996	1.999	0.5328
	0.6	7.187	5.794	3.908	1.954	0.5206
	0.7	7.052	5.663	3.819	1.908	0.5082
	0.8	6.914	5.533	3.731	1.862	0.4957

TABLE II (Cont'd.)

P	K	$\theta = 15^{\circ}$	$\theta = 30^{\circ}$	$\theta = 45^{\circ}$	$\theta = 60^{\circ}$	$\theta = 75^{\circ}$
1.75	0	9.642	7.935	5.363	2.695	0.7211
	0.2	9.364	7.678	5.199	2.613	0.6991
	0.4	9.077	7.383	4.997	2.510	0.6712
	0.5	8.928	7.229	4.888	2.454	0.6561
	0.6	8.775	7.073	4.778	2.398	0.6407
	0.7	8.620	6.918	4.668	2.341	0.6253
	0.8	8.462	6.763	4.559	2.285	0.6100
2.00	0	11.37	9.335	6.343	3.194	0.8564
	0.2	11.02	9.018	6.128	3.087	0.8277
	0.4	10.64	8.665	5.874	2.958	0.7930
	0.5	10.47	8.485	5.742	2.891	0.7747
	0.6	10.30	8.304	5.609	2.823	0.7563
	0.7	10.13	8.125	5.478	2.755	0.7379
	0.8	9.955	7.948	5.348	2.688	0.7197

Note: Volume = $4ab^2(S_2 q/f)^{\frac{1}{2}}\cos\theta = L(q/f)^{\frac{1}{2}}a^3$, where S_2 is the coefficient for the maximum edge stress in TABLE I, f is the allowable stress of a material, and L is the volume coefficient in the table.

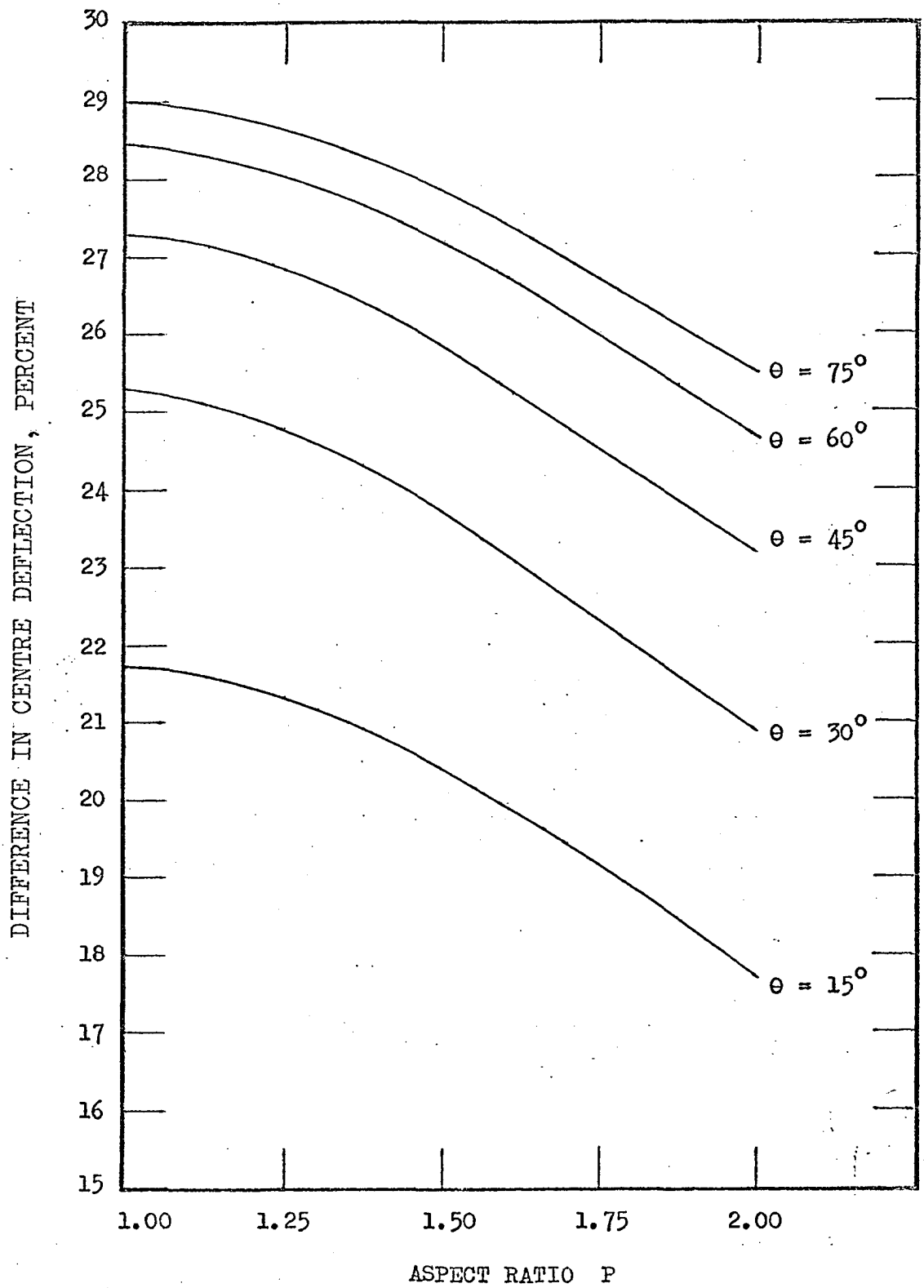


Fig. 3. Variations in the Percentage Differences in the Value of Centre Deflection Coefficient W_1 Corresponding to K = 0 and K = 0.8 with Aspect Ratio P and Various Skew Angle θ

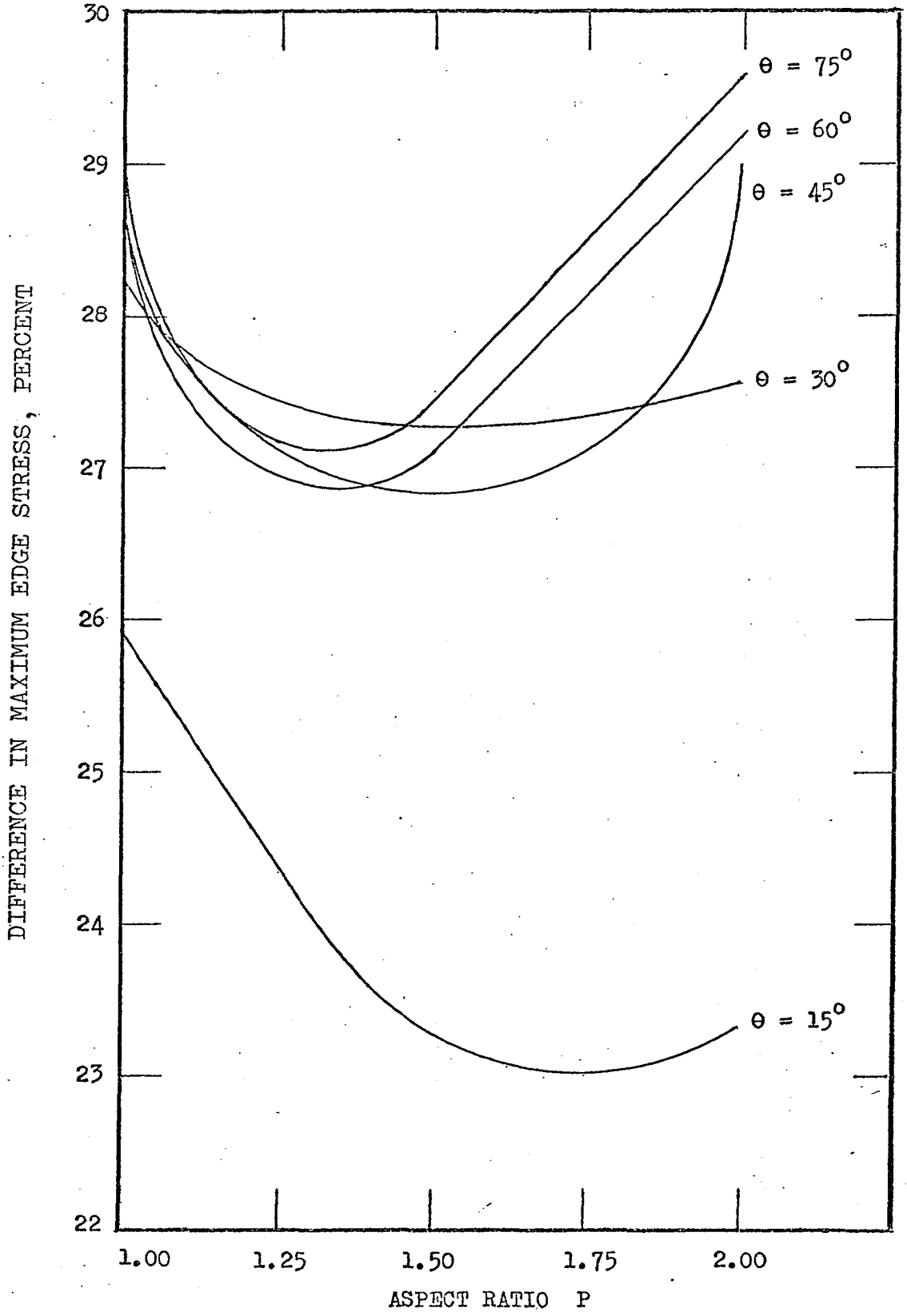


Fig. 4. Variations in the Percentage Differences in the Value of Maximum Edge Stress Coefficient S_2 Corresponding to K = 0 and K = 0.8 with Aspect Ratio P and Various Skew Angle θ

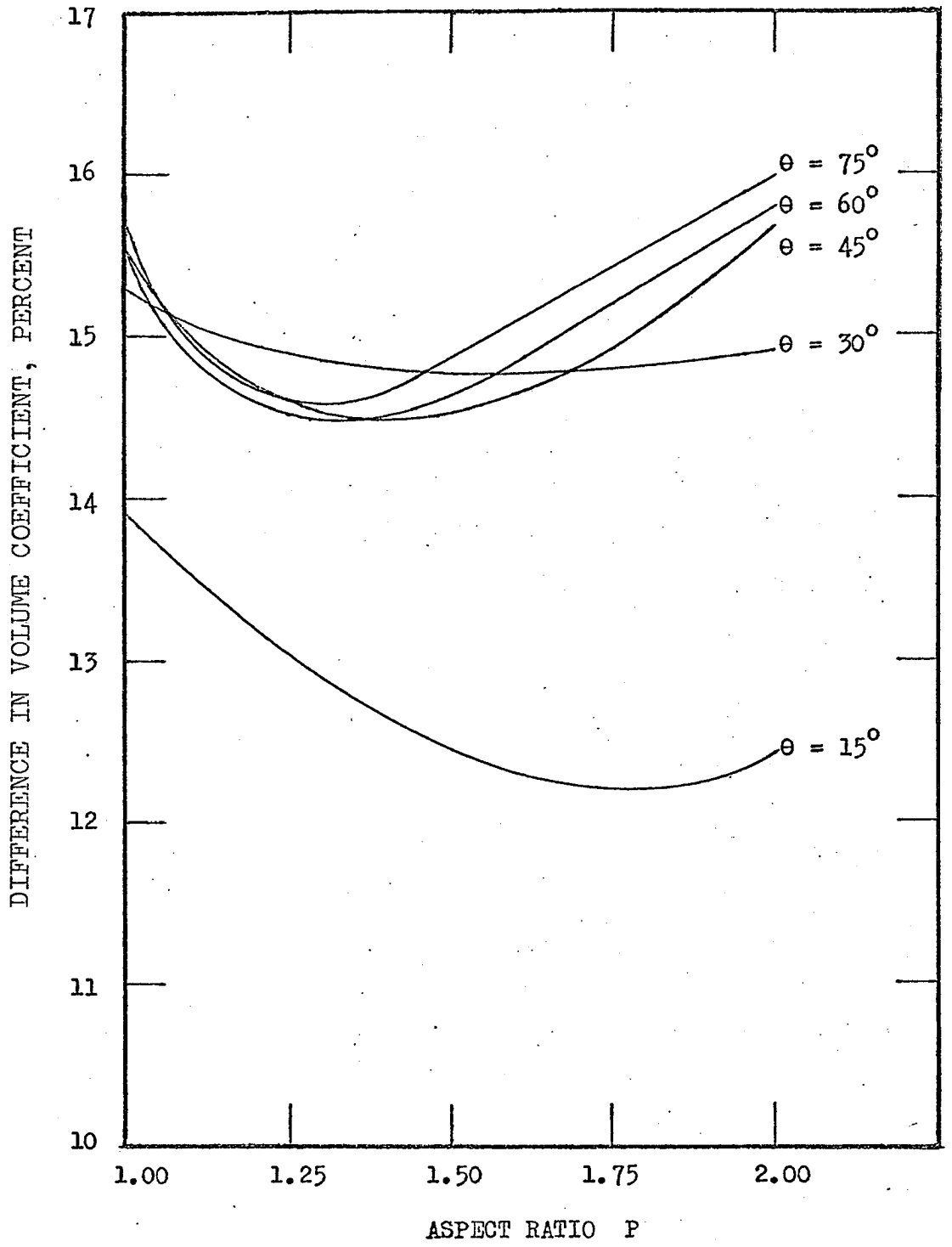


Fig. 5. Variations in the Percentage Differences in the Value of Volume Coefficient L Corresponding to K = 0 and K = 0.8 with Aspect Ratio P and Various Skew Angle θ

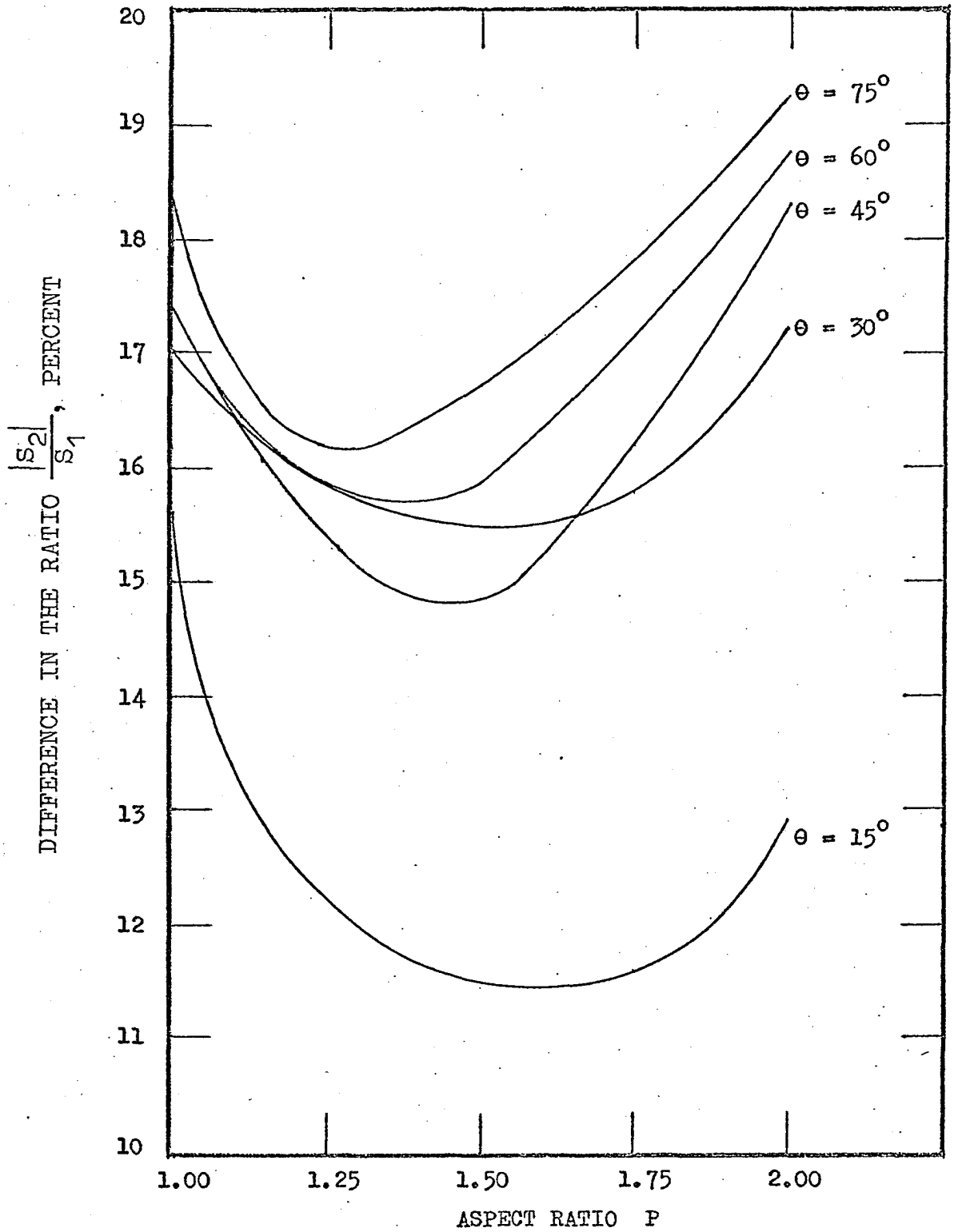


Fig. 6. Variations in the Percentage Differences in the Value of the Ratio of the Max. Edge Stress Coefficient S_2 to the Max. Centre Stress Coefficient S_1 Corresponding to K = 0 and K = 0.8 with Aspect Ratio P and Various Skew Angle θ

TABLE III

Comparison of Deflections and Moments Obtained

by Using Different Number of Parameters

(Deflection = $W_1(b^4q/D_o)(10)^{-4}$, Moment = $M_i b^2 q(10)^{-2}$)

K = 0.5		θ	P	NUMBER OF PARAMETERS			
				1	2	3	4
CENTRE	W_1	15°	1.00	157.0	156.5	156.1	156.8
		15°	1.50	54.75	52.97	53.80	53.88
		30°	1.00	99.71	99.29	98.99	101.9
		60°	1.00	9.828	9.722	9.655	10.32
		60°	1.50	3.560	3.429	3.474	3.674
	M_1	15°	1.00	8.227	8.153	8.077	8.262
		15°	1.50	5.658	5.370	5.720	5.764
		30°	1.00	6.980	6.884	6.813	7.616
		60°	1.00	2.280	2.191	2.135	2.627
		60°	1.50	1.393	1.256	1.333	1.597
$\eta = -0.3$ $\xi = 1$	M_2	15°	1.00	-6.614	-6.606	-6.725	-6.688
		15°	1.50	-5.189	-5.147	-4.699	-4.687
		60°	1.00	-1.545	-1.540	-1.635	-1.645
		60°	1.50	-1.259	-1.251	-1.134	-1.125

Poisson's ratio $\nu = 0.3$ $\quad i = 1, 2$

TABLE IV

Comparison of Centre Deflections and Maximum Moments at Centre and Edge for Clamped Skewed Plates of Constant Thickness with Kennedy's Results

(Deflection = $W_1(b^4q/D_o)(10)^{-4}$, Moment = $M_i b^2 q(10)^{-2}$)

θ	P	CENTRE				EDGE	
		W_1		M_1		$-M_2$	
		Author	Ref. 14	Author	Ref. 14	Author	Ref. 14
15^o	1.00	180.9	180.7	8.894	8.811	19.95	19.86
	1.50	61.58	61.67	6.264	6.218	13.73	13.53
	2.00	22.21	22.44	3.891	3.906	9.019	8.670
30^o	1.00	121.0	120.5	8.208	7.906	16.45	15.83
	1.50	41.33	41.27	5.227	5.101	11.55	10.82
	2.00	14.98	15.08	3.248	3.217	7.564	6.970
45^o	1.00	52.70	52.44	5.720	5.383	11.14	10.40
	1.50	18.26	18.22	3.505	3.338	7.821	7.070
	2.00	6.740	6.773	2.184	2.146	5.239	4.650
60^o	1.00	12.59	12.53	2.822	2.610	5.507	5.509
	1.50	4.438	4.429	1.719	1.632	3.916	3.510
	2.00	1.673	1.682	1.081	1.058	2.657	2.330
75^o	1.00	0.8680	0.8644	0.7363	0.6742	1.451	1.339
	1.50	0.3099	0.3096	0.4500	0.4242	1.042	0.9270
	2.00	0.1187	0.1195	0.2856	0.2791	0.7128	0.6270

Poisson's ratio $\nu = 0.3$ $\quad i = 1, 2$

CHAPTER IV

EXPERIMENTAL ANALYSIS

(a) Model Making

To make the plate model, a mould was first made. The mould frame was made of 1/2 in. thick sheet plexiglas, which was then filled with Ultracal plaster paste. The top surface, that of a hyperbolic paraboloid, was generated by striking off the material with a straight edge moving along the top edges of the sides of the box. After the plaster paste was dry and hard, the surface of the mould was sprayed with black paint. The mould was 2 in. thick at the obtuse corners, and $1\frac{1}{4}$ in. at the acute corners, with the other dimensions being the same as those of the intended model (photograph A). A skewed plate was then cut out from a nominal 1 in. thick sheet plexiglas to the required plane view dimensions, leaving 3 inches all around for clamping purposes. Then with the help of a copying machine, the plate was cut to the required hyperbolic paraboloid shape as copied from the mould with all possible accuracy. To avoid stress concentrations, each of the 3 in. wide strips left at each edge of the plate for clamping purposes was first cut to the same thickness as that of the corresponding edge of the model. The strips were then made into the same thickness (about 1 in.) gluing tightly each of them to a 3 in. wide wooden plank (photograph A).

The geometries of the plate model were as follows:

Panel length $2b = 30$ in.

Aspect ratio $P = b/a = 1.50$

Skew angle $\theta = 30^{\circ}$

Thickness coefficient K = 0.6

Thickness at acute corners: 0.210 in.

Thickness at obtuse corners: 0.910 in.

Thickness at centre: 0.550 in.

Only one plate model was tested, for it was quite expensive to make the plate model.

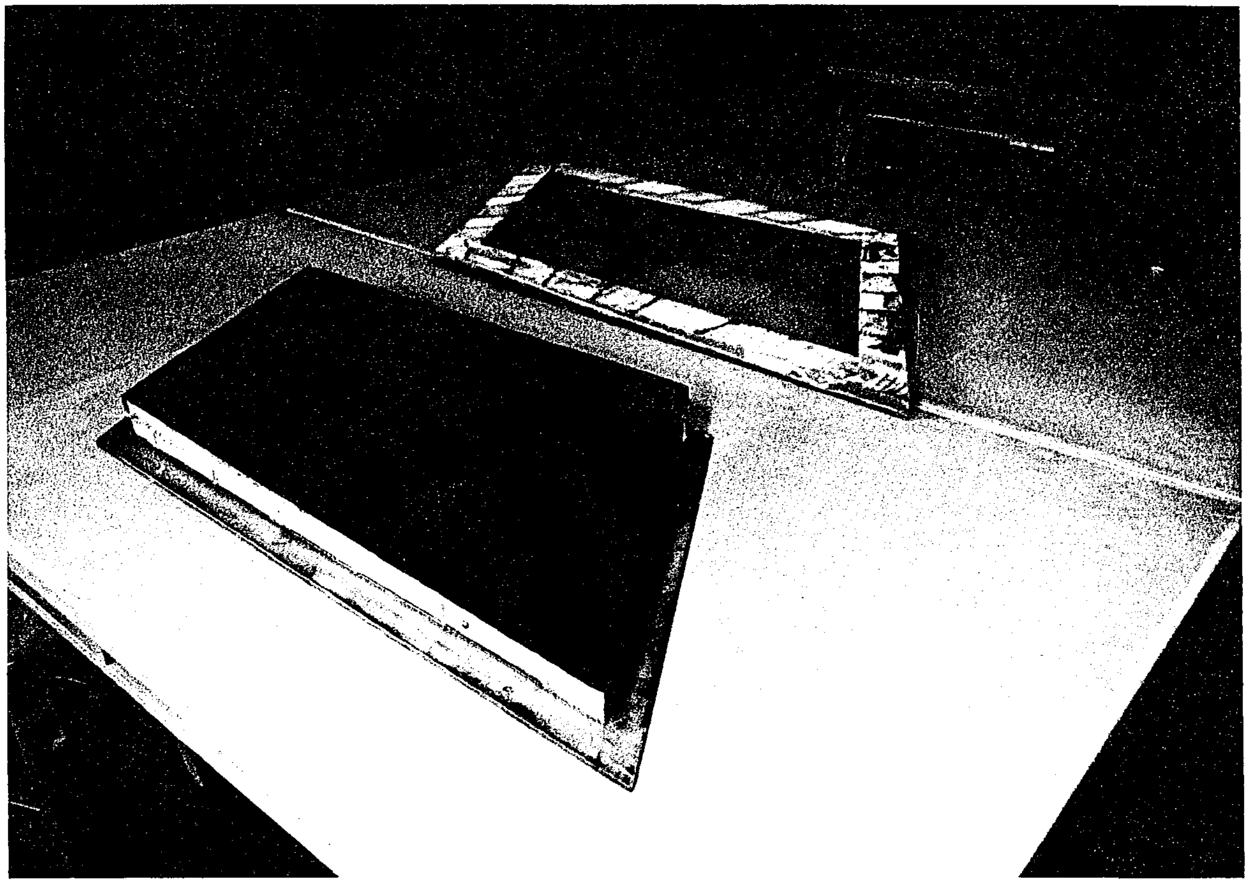


PHOTO. A THE MOULD AND THE PLATE MODEL

(b) Tensile Tests on Plexiglas

To determine the Young's modulus and Poisson's ratio of the plexiglas, five specimens cut out from the same sheet of plexiglas used in making the model were tested. Their dimensions were in accordance with the requirements of the ASTM Standard for nominal 1 in. thick plastic materials. To measure the longitudinal and transverse strains, a 2-legged strain gauge of 1/8 in. gauge length was installed on each of the specimens at the intersection of the two symmetrical axes. The strains were recorded (for method of recording see P. 43) for each load increment of 250 lds.

The average values of Poisson's ratio and Young's modulus were found to be 0.3 and 470,000 psi., respectively.

(c) Apparatus and Procedures

Four metal-foil strain rosette gauges for plastic materials were installed on the plate model at selected locations. All these rosette gauges are of the 3-legged 45° rectangular type, having a gauge factor of 1.97, a resistance of 120 ohms and a gauge length of 1/16 in. Terminal strips (type T-50) were used to connect the lead wires to the gauge tabs. The lead wires were made of No. 26 stranded copper wire and with vinyl insulation.

A skewed frame, used in previous experiments, was re-used as the supporting structure. The plate model was cut to suit the dimensions of the existing frame which was made from four standard steel channels with 3 in. wide flanges, 12 in. deep and weighing 20.7 pounds per foot. The channels were stiffened with 1/4 in. vertical stiffeners, spaced 6 in. apart. The frame was supported by four structural steel posts.

The test plate with all the strain gauges installed was placed on the supporting frame, with the flat surface facing downwards. To simulate the clamped edge conditions, the panel edges were sandwiched between the flange of the channel and a 1 in. thick, 3 in. wide, cold-rolled steel cover plate. A 1/4 in. thick plate cut into the same skew and dimensions as the panel was in turn placed on top of the cold-rolled steel cover plate, and the entire edge assembly was then clamped by special clamps, spaced 3 in. apart. To create an air-tight chamber between the 1/4 in. plate and the test panel, thin leather gaskets were inserted immediately above and below the edges of the panel. The uniform lateral pressure was provided by compressed air, measured with a manometer which was connected to the vicinity of the

centre of the panel. A liquid of 2.95 specific gravity was used for the manometer.

The strains were measured by means of two " Switch and Balancing " units (model C10LC, Budd Instrument Division), a digital strain indicator and an automatic print out unit (photogrph B). To measure lateral displacements, three 1/1000 in. dial indicators were installed at the bottom of the plate in selected locations.

The locations of the dial indicators and the strain gauges in terms of the oblique co-ordinate axes V and U are tabulated in TABLE V.

Three independent tests were performed on the plate model within the elastic limit with test data obtained for both loading and unloading. All experimental results for deflections, principal stresses and moments reported herein represent an average value of this test. Both the strain and lateral deflection readings are included in APPENDIX B.

From the values of unit strains E_a, E_b and E_c obtained from each rosette gauge, the principal stresses and moments were calculated in the usual manner:

$$\sigma_{max} = \frac{E}{2}\left[\frac{E_a + E_c}{(1-\nu)} + \frac{1}{(1+\nu)}\sqrt{2(E_a - E_b)^2 + 2(E_b - E_c)^2}\right] \quad \text{.....(4-1)}$$

$$\sigma_{min} = \frac{E}{2}\left[\frac{E_a + E_c}{(1-\nu)} - \frac{1}{(1+\nu)}\sqrt{2(E_a - E_b)^2 + 2(E_b - E_c)^2}\right] \quad \text{.....(4-2)}$$

$$M_{max} = \frac{h^2}{6}\sigma_{max} \quad \text{.....(4-3)}$$

$$M_{min} = \frac{h^2}{6}\sigma_{min} \quad \text{.....(4-4)}$$

To facilitate the computational work, a programme in Fortran was written for an IBM computer (APPENDIX A) to obtained the principal stresses and moments.

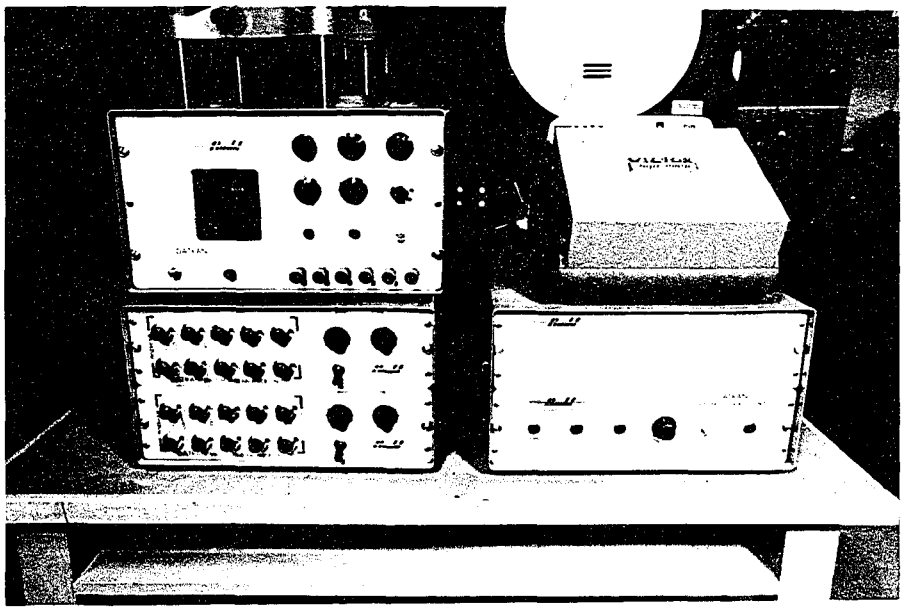


PHOTO. B DIGITAL STRAIN INDICATOR AND AUTOMATIC PRINT-OUT DIVICE

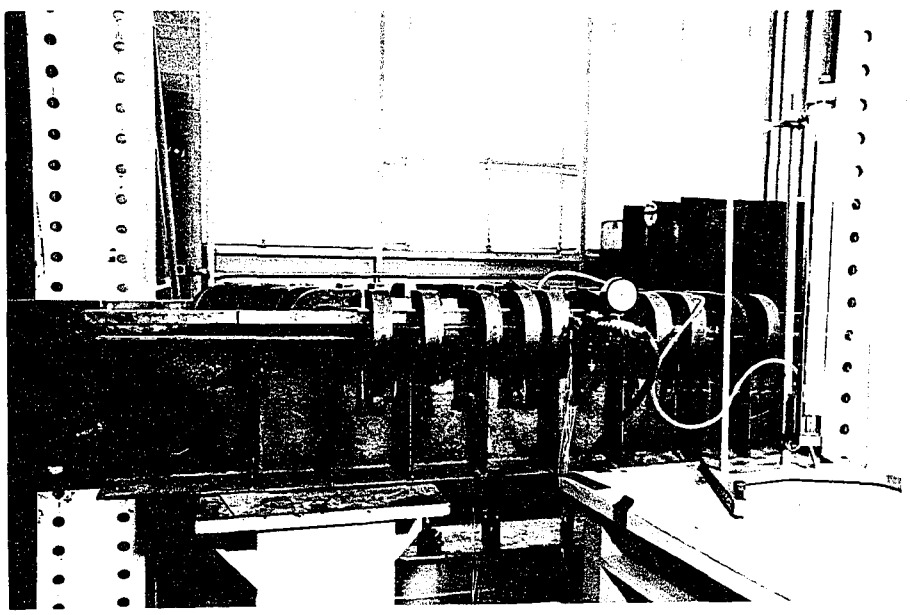


PHOTO. C TEST SET-UP

TABLE V

Locations of Strain Gauges and Dial Indicators

	Point	V, in.	U, in.
Strain Gauges	A*	-6.00	9.75
	B*	0	9.75
	C*	-14.75	9.75
	D**	0	0
Dial Ind.	D	0	0
	E	-7.50	5.00
	F	7.50	5.00

*: Gauge on top surface.

**: Gauge on bottom surface.

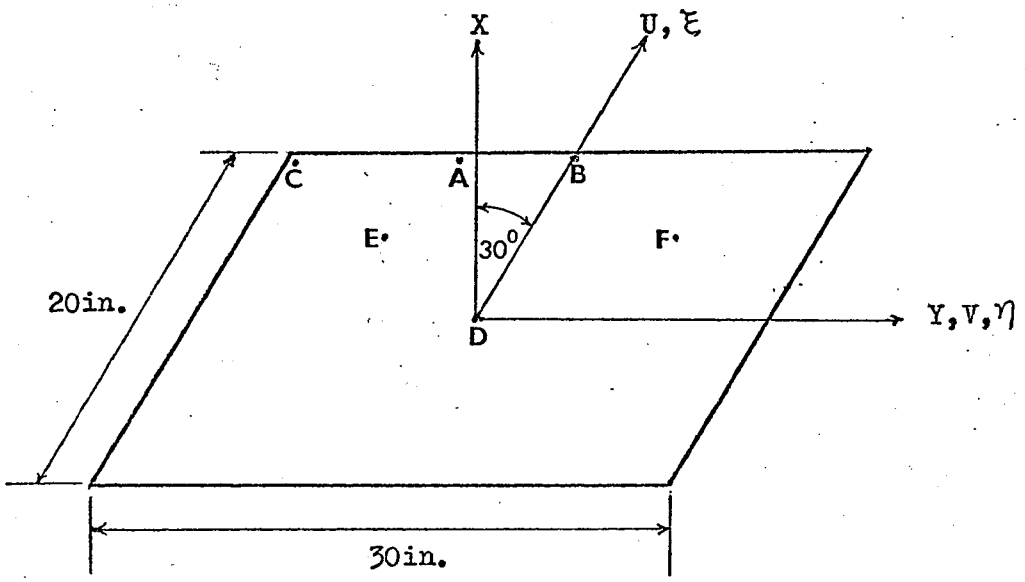


Fig. 7. Plane View Dimensions of Test Plate Model and Locations of Strain Gauges and Dial Indicators

(d) Observation and Comparison of Experimental Results with Theoretical Results

Experimental and theoretical results for deflections, stresses and moments at various points on the plate are plotted in Figs. 8, 9 and 10, respectively. Observing these figures, it can be seen that the experimental results at the centre, point D, and the middle of the longer edge, point B, are higher than the theoretical results, while at point A the theoretical results are conservative. These deviations may be due to the yielding of the edges of the plate, which would increase the deflections, stresses and moments at the centre, and decrease the stresses and moments at the edges. Since the ideal theoretical clamping conditions assumed in the analytical solution can never be realized in practice, the discrepancy between the experimental and theoretical values in the lateral displacement of clamped plates will always exist and must be taken into account in the design of such plates.

The average percentage differences between the theoretical and experimental results are shown in the following table:

Point	Deflection	Stress	Moment
A	—	27	28
B	—	13	9
D	21	21	18

It has been experimentally observed that for a clamped skewed plate of constant thickness under a uniform pressure the magnitudes of the maximum stresses in the vicinity of the obtuse corners were of

the same order as maximum stresses at the centre,[12] but examining Fig. 9, one can observe that the stress at the obtuse corner, point C, is only about 42% of that at the centre. This phenomenon is of course due to the fact that the thickness at the obtuse corners have been increased relative to that at the acute corners or the centre.

The stress at point A is slightly lower than the stress at point B, which is contrary to the theoretical prediction. According to the theoretical analysis, point A is the position where the highest stress in the plate will occur. This deviation might be due to errors made in the experiment. Theoretical results show that the ratio of the stress at point A to that at the centre is 1.96, while the experimental results show that it is only 1.12.

It may be interesting to observe that the moment at the obtuse corner is nearly the same in magnitude as that at the centre.

Besides the possible yielding of the clamped edges of the plate, the deviations from the experimental to the theoretical results might be due to the following reasons:

(1) Inaccuracy of the plate model;

(2) Possible drifting of strain gauges due to the heat from the current;

(3) Possible weakening of the plexiglas at spots where the solder-pen was applied to connect lead wires to strain gauges.

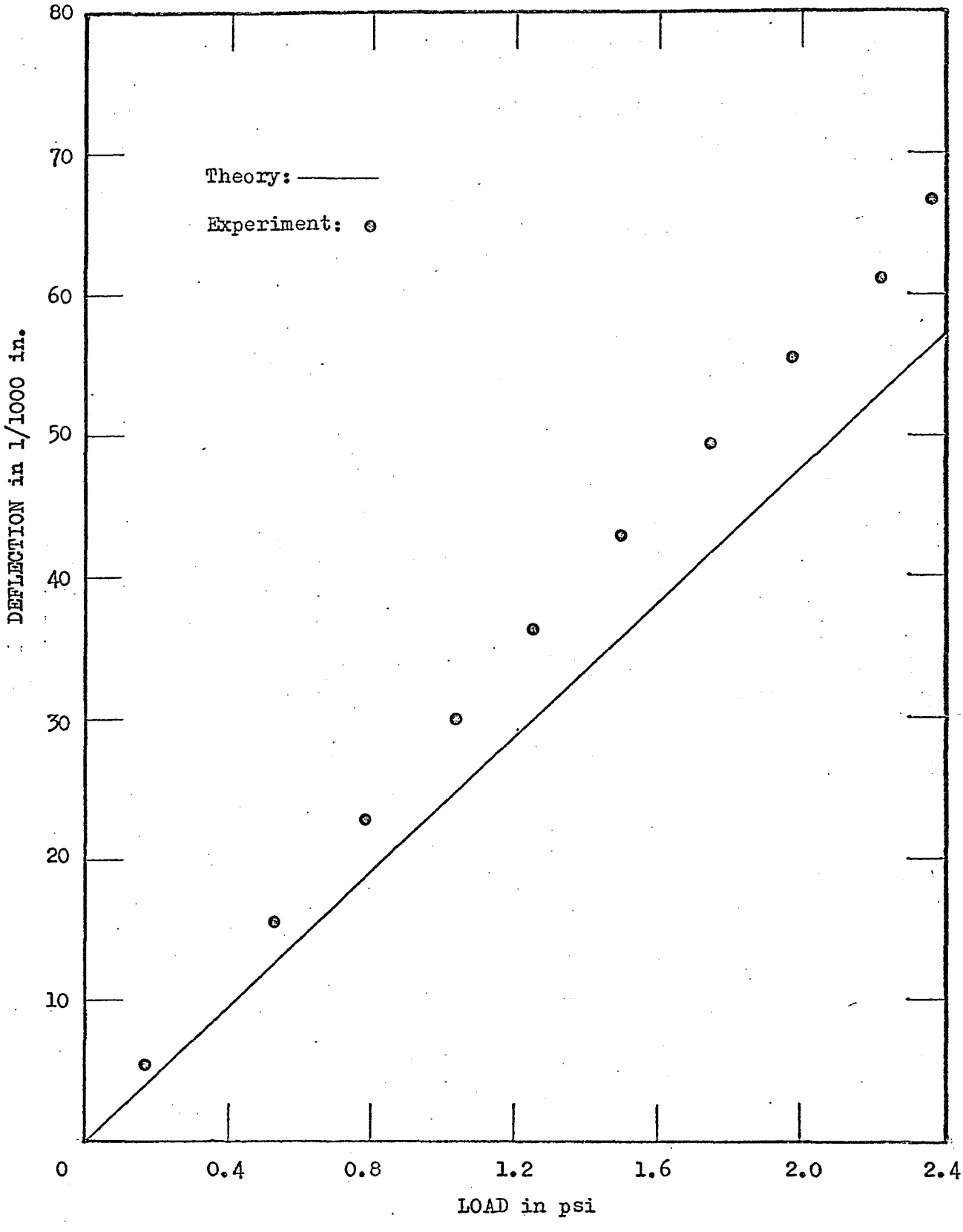


Fig. 8. Experimental and Theoretical Results for Centre Deflections

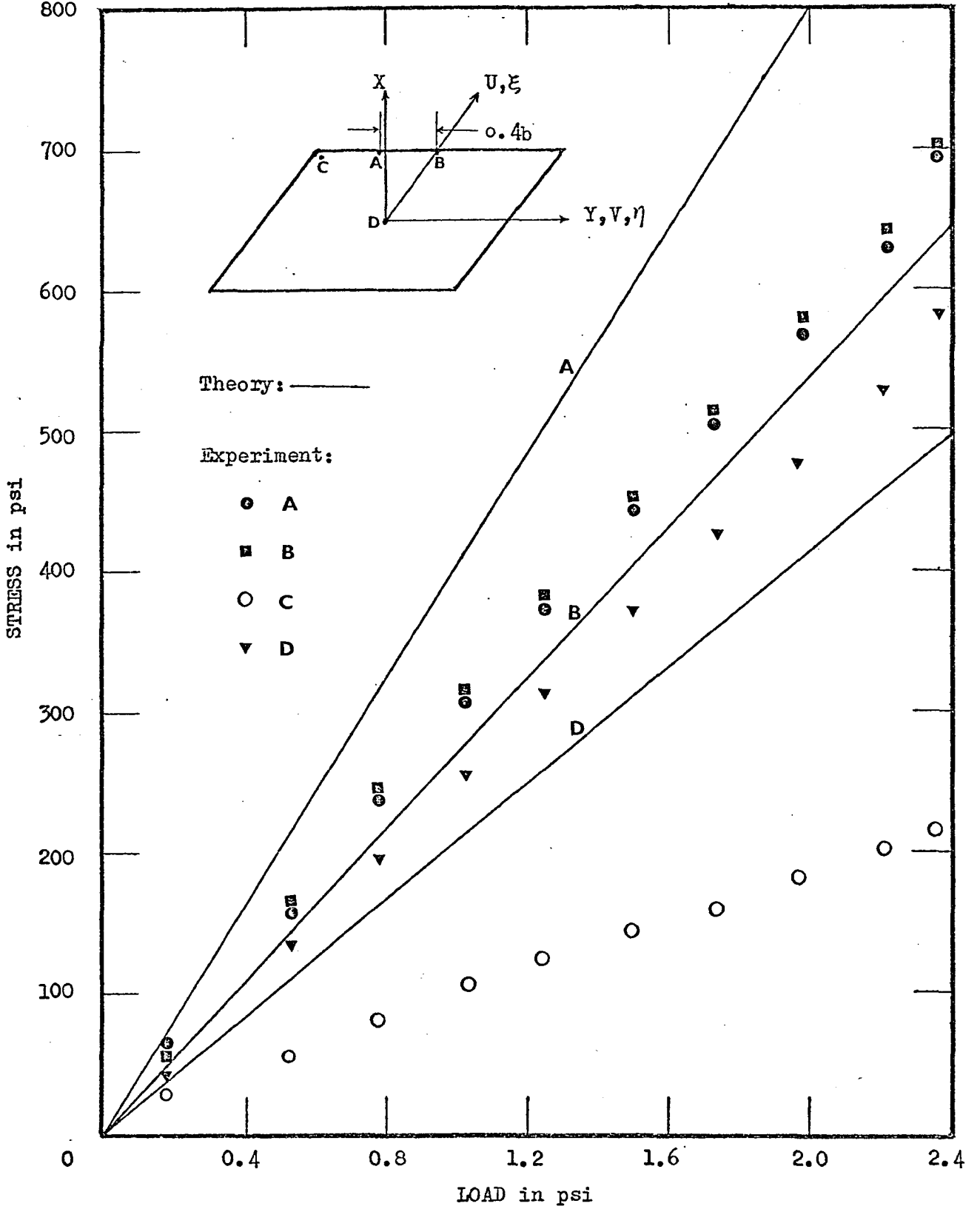


Fig. 9. Experimental and Theoretical Results for Principal Stresses

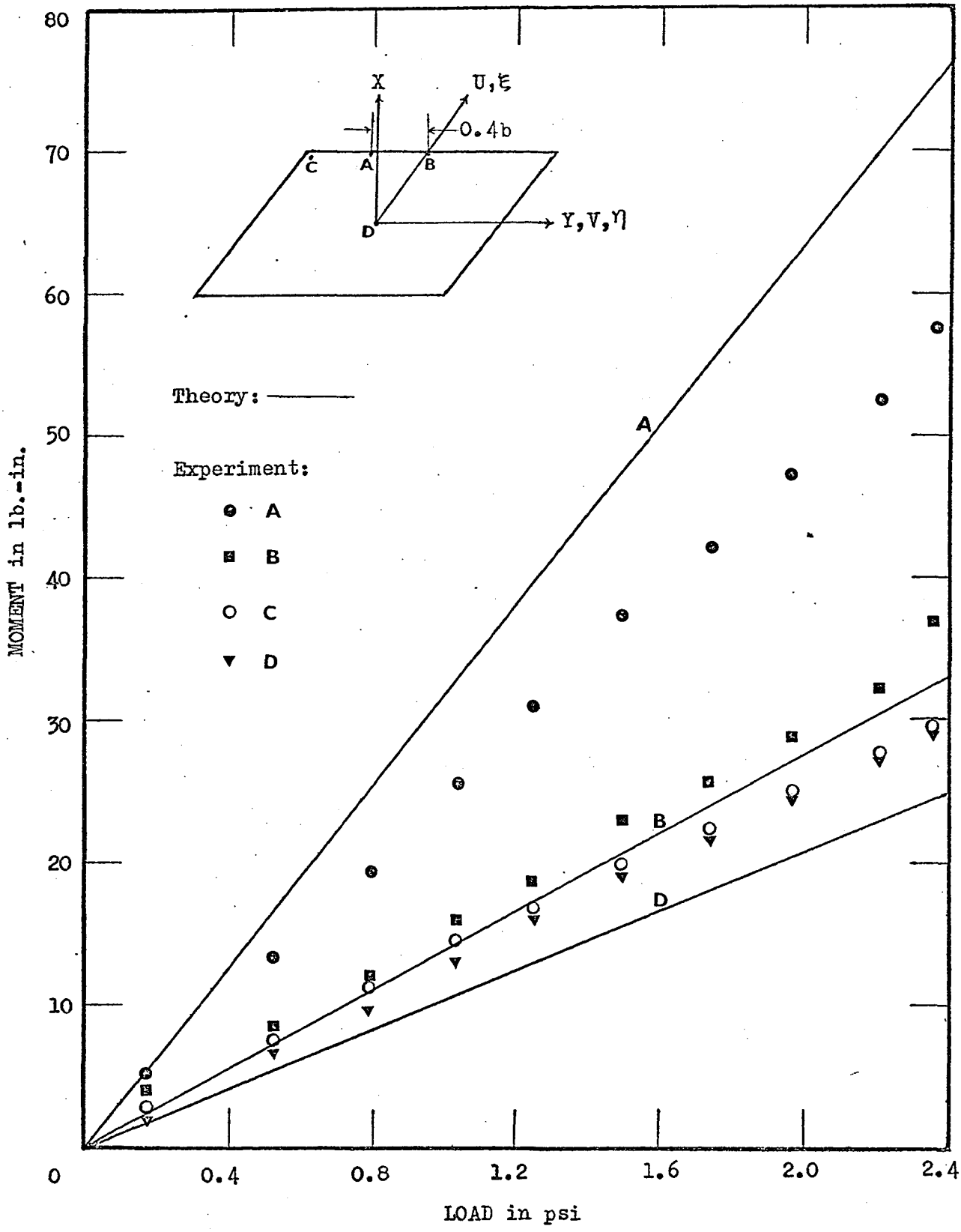


Fig. 10. Experimental and Theoretical Results for Principal Moments

CHAPTER V

CONCLUSIONS

As a result of this theoretical and experimental investigation on clamped skewed plates with variable thickness under a uniform load, the following conclusions may be drawn:

1. The highest stress in the plate occurs along the longer edge and is displaced towards the obtuse corner.
2. The positions of the highest moment and stress in the plate do not coincide, generally, with the former being closer to the obtuse corner.
3. Centre deflections and maximum stresses at the centre and along the longer edge decrease with increasing ratio of plate thickness at the obtuse corner to that at the acute corner.
4. The ratio of the highest stress in the plate to the maximum stress at the centre decreases with increasing thickness ratio mentioned in 3.
5. Deflections, moments and stresses decrease with increase in skew and aspect ratio.
6. Experimental results indicate that the ratio of the stress in the vicinity of the obtuse corner to that at the centre is less than that for clamped skewed plates of constant thickness.[12]

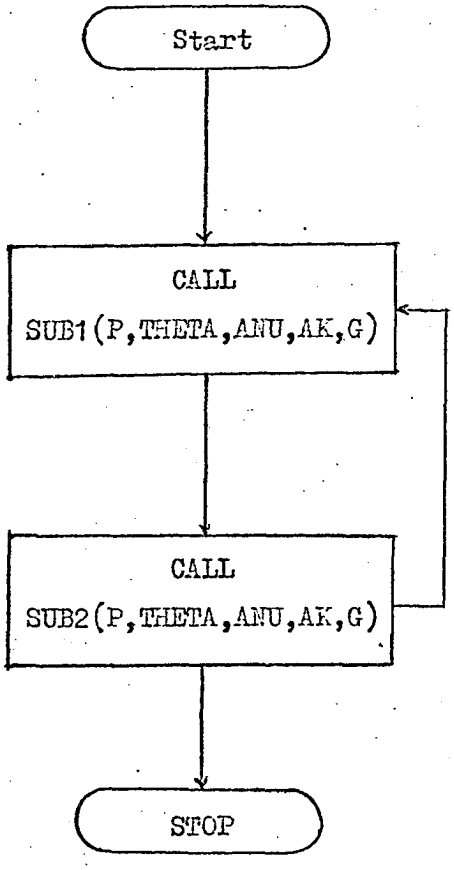
APPENDIX A

COMPUTER PROGRAMMES

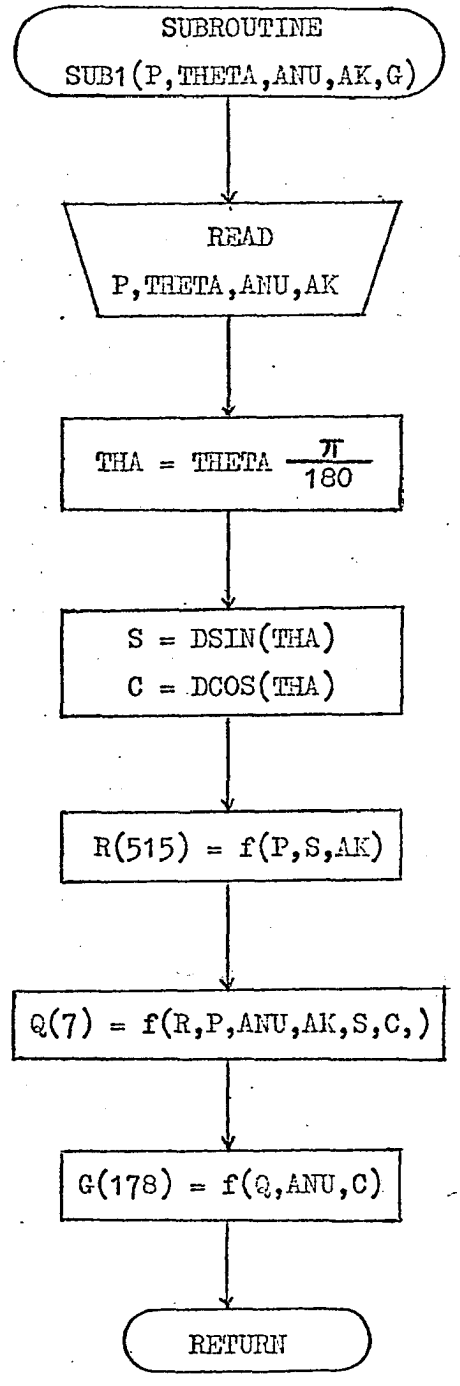
(a) List of Variables

Programme Language:	Meaning:
P	aspect ratio P
THETA	skew angle θ
ANU	Poisson's ratio ν
AK	thickness coefficient K
BIGM(1,1).....BIGM(4,4)	elements at left side of matrix equation
V(1).....V(4)	elements at rigth side of matrix equation, also parameters C_o, C_1, C_2 and C_3
ETA, AXI	oblique dimensionless co-ordinates η and ξ
DEFL	deflection W
AMX, AMY	bending moments M_x and M_y
AMXY	twisting moment M_{xy}
AMMAX, AMMIN	maximum and minimum principal moments M_{max} and M_{min}
SMAX, SMIN	maximum and minimum principal stresses σ_{max} and σ_{min}
ALPHA	angle ϕ, direction of maximum principal moment or stress
E	Young's modulus
EA, EB, EC	unit strains in the three legs of a rosette gauge E_a, E_b and E_c
T	thickness of plate h or h_o

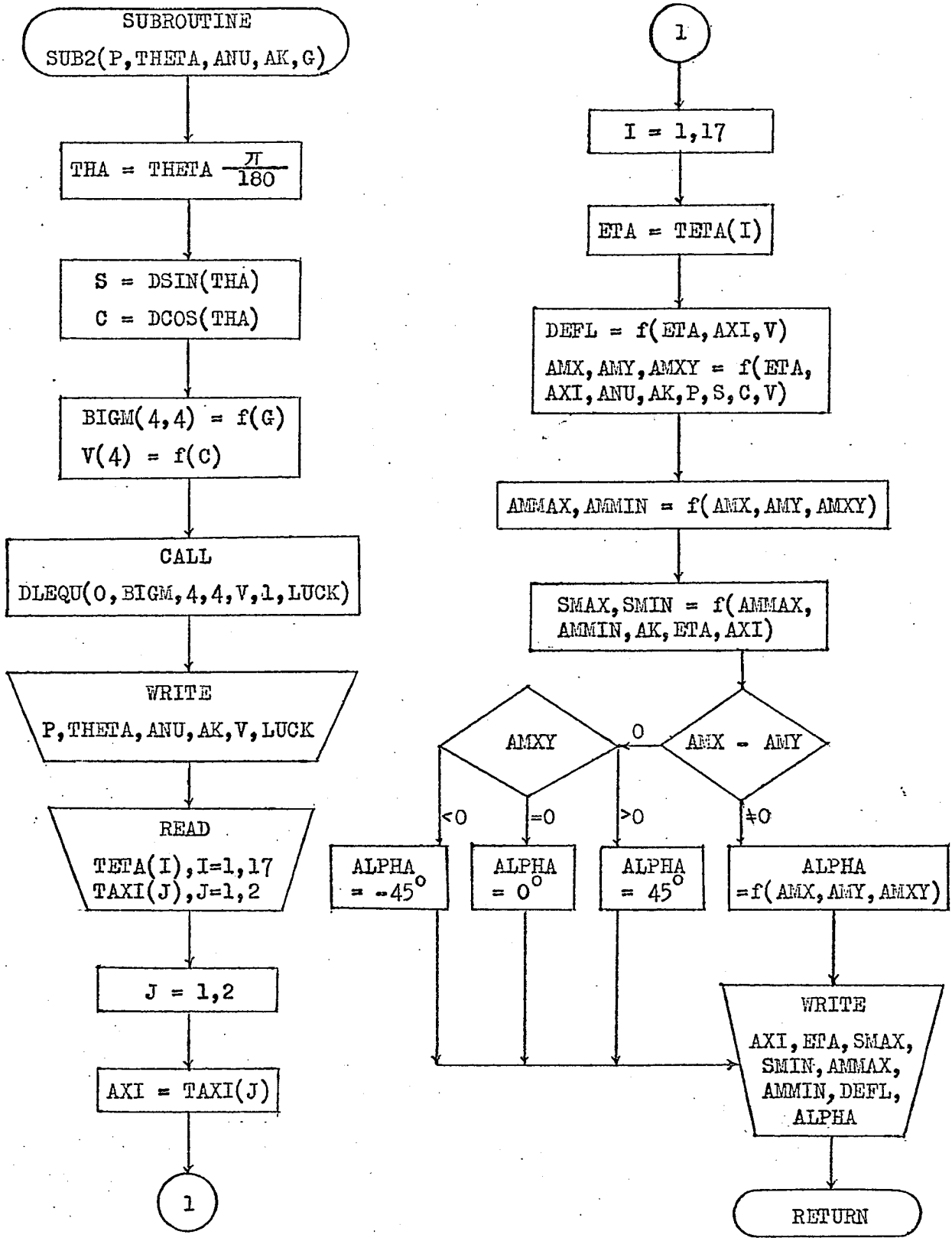
(b) Flowchart of Programme for Theoretical Analysis



Main Link.



Overlay Subroutine SUB1



Overlay Subroutine SUB2

(c) Fortran Programme for Theoretical Analysis

(For IBM 7094 Computer)

```
C                    ANALYSIS OF CLAMPED SKEWED PLATES
C                         WITH VARIABLE THICKNESS
      DOUBLE PRECISION G(178)
  373 CALL SUB1(P,THETA,ANU,AK,G)
      CALL SUB2(P,THETA,ANU,AK,G)
      GO TO 373
      END

$ORIGIN      A
$IBFTC SUBA
      SUBROUTINE SUB1(P,THETA,ANU,AK,G)
      DOUBLE PRECISION R(515),G(178),Q1,Q2,Q3,Q4,Q5,Q6,Q7,A1,A2,A3,A4,
     XA5,A6,A7,A8,A9,A10,A11,A12,B1,B2,B3,B4,B5,B6,B7,B8,B9,B10,B11,B12,
     XB13,B14,B15,B16,B17,B18,B19,B20,B21,B22,B23,B24,THA,P2,P3,S2,C2,
     XAK2,AK3,Z,YU
      READ (5,99) P,THETA,ANU,AK
   99 FORMAT (4F6.3)
      THA=THETA*3.1415926535897 9/180.
      S=DSIN(THA)
      C=DCOS(THA)
      P2=P*P
      P3=P2*P
      S2=S*S
      A1=P2*P2
      A2=-4.*S*P3
      A3=2.*P2*(1.+2.*S2)
      A4=-4.*S*P
      A5=P3
      A6=-3.*S*P2
      A7=P*(1.+2.*S2)
      A8=-S
      A9=P2
      A10=-2.*S*P
      A11=P
      A12=S2
      AK2=AK*AK
      AK3=AK2*AK
      B1=-3.*AK
      B2=3.*AK2
      B3=-AK3
      B4=S*AK
      B5=-P*AK
      B6=-2.*S*AK2
      B7=2.*P*AK2
      B8=S*AK3
      B9=-P*AK3
      B10=-AK
      B11=2.*AK2
      B12=S*P*AK
```

```
      B13=AK2
      B14=-4.*S*P*AK2
      B15=P2*AK2
      B16=3.*S*P*AK3
      B17=-P2*AK3
      B18=S2*AK2
      B19=-S2*AK3
      B20=P*AK
      B21=2.*S*AK2
      B22=-4.*P*AK2
      B23=-2.*S*AK3
      B24=3.*P*AK3
      C2=C*C
      Z=6.*C2
      YU=Z*(ANU-1.)
      R(1)=24.*A1+12.*A2+16.*A3+12.*A4+24.
      R(2)=-60.*A2-48.*A3-72.*A4-48.
      R(3)=-120.*A1-96.*A2-144.*A3-96.*A4-120.
      R(4)=-48.*A1-72.*A2-48.*A3-60.*A4
      R(5)=60.*A4+24.
      R(6)=240.*A3+96.*A4+240.
      R(7)=360.*A2+144.*A3+360.*A4
      R(8)=240.*A1+96.*A2+240.*A3
      R(9)=24.*A1+60.*A2
      R(10)=-120.
      R(11)=-300.*A4
      R(12)=-400.*A3
      R(13)=-300.*A2
      R(14)=-120.*A1
      R(15)=-8.*A3-6.*A4-48.
      R(16)=24.*A3+36.*A4+96.
      R(17)=48.*A2+72.*A3+192.*A4+240.
      R(18)=24.*A1+36.*A2+96.*A3+120.*A4+360.
      R(19)=-30.*A4-48.
      R(20)=-120.*A3-192.*A4-480.
      R(21)=-180.*A2-288.*A3-720.*A4-720.
      R(22)=-120.*A1-192.*A2-480.*A3-480.*A4-840.
      R(23)=-48.*A1-120.*A2-120.*A3-210.*A4
      R(24)=240.
      R(25)=600.*A4+360.
      R(26)=800.*A3+480.*A4+1680.
      R(27)=600.*A2+360.*A3+1260.*A4
      R(28)=240.*A1+144.*A2+504.*A3
      R(29)=24.*A1+84.*A2
      R(30)=-840.
      R(31)=-1050.*A4
      R(32)=-840.*A3
      R(33)=-420.*A2
      R(34)=R(14)
      R(35)=-48.*A1-6.*A2-8.*A3
      R(36)=360.*A1+120.*A2+96.*A3+36.*A4+24.
      R(37)=240.*A1+192.*A2+72.*A3+48.*A4
      R(38)=96.*A1+36.*A2+24.*A3
      R(39)=-210.*A2-120.*A3-120.*A4-48.
      R(40)=-840.*A1-480.*A2-480.*A3-192.*A4-120.
```

```
R(41)=-720.*A1-720.*A2-288.*A3-180.*A4
R(42)=-480.*A1-192.*A2-120.*A3
R(43)=-48.*A1-30.*A2
R(44)=84.*A4+24.
R(45)=504.*A3+144.*A4+240.
R(46)=1260.*A2+360.*A3+600.*A4
R(47)=1680.*A1+480.*A2+800.*A3
R(48)=360.*A1+600.*A2
R(49)=240.*A1
R(50)=R(10)
R(51)=-420.*A4
R(52)=R(32)
R(53)=-1050.*A2
R(54)=-840.*A1
R(55)=4.*A3
R(56)=-48.*A3-18.*A4-48.
R(57)=-96.*A2-36.*A3-96.*A4
R(58)=-48.*A1-18.*A2-48.*A3
R(59)=60.*A3+60.*A4+96.
R(60)=240.*A2+240.*A3+384.*A4+240.
R(61)=360.*A1+360.*A2+576.*A3+360.*A4+360.
R(62)=240.*A1+384.*A2+240.*A3+240.*A4
R(63)=96.*A1+60.*A2+60.*A3
R(64)=-42.*A4-48.
R(65)=-252.*A3-288.*A4-480.
R(66)=-630.*A2-720.*A3-1200.*A4-720.
R(67)=-840.*A1-960.*A2-1600.*A3-960.*A4-840.
R(68)=-720.*A1-1200.*A2-720.*A3-630.*A4
R(69)=-480.*A1-288.*A2-252.*A3
R(70)=-48.*A1-42.*A2
R(71)=R(24)
R(72)=840.*A4+360.
R(73)=1680.*A3+720.*A4+1680.
R(74)=2100.*A2+900.*A3+2100.*A4
R(75)=1680.*A1+720.*A2+1680.*A3
R(76)=360.*A1+840.*A2
R(77)=R(49)
R(78)=R(30)
R(79)=-1470.*A4
R(80)=-1764.*A3
R(81)=-1470.*A2
R(82)=R(54)
R(83)=24.*A5+12.*A6+16.*A7+12.*A8
R(84)=12.*A5+16.*A6+12.*A7+24.*A8
R(85)=-20.*A6-16.*A7-24.*A8
R(86)=-60.*A5-48.*A6-72.*A7-48.*A8
R(87)=-48.*A5-72.*A6-48.*A7-60.*A8
R(88)=-24.*A5-16.*A6-20.*A7
R(89)=12.*A8
R(90)=60.*A7+24.*A8
R(91)=120.*A6+48.*A7+120.*A8
R(92)=120.*A5+48.*A6+120.*A7
R(93)=24.*A5+60.*A6
R(94)=12.*A5
R(95)=-60.*A8
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R(96)=-100.*A7
R(97)=-100.*A6
R(98)=-60.*A5
R(99)=-8.*A7-6.*A8
R(100)=-8.*A6-6.*A7-48.*A8
R(101)=8.*A7+12.*A8
R(102)=24.*A6+36.*A7+96.*A8
R(103)=24.*A5+36.*A6+96.*A7+120.*A8
R(104)=12.*A5+32.*A6+40.*A7+120.*A8
R(105)=-6.*A8
R(106)=-30.*A7-48.*A8
R(107)=-60.*A6-96.*A7-240.*A8
R(108)=-60.*A5-96.*A6-240.*A7-240.*A8
R(109)=-48.*A5-120.*A6-120.*A7-210.*A8
R(110)=-24.*A5-24.*A6-42.*A7
R(111)=120.*A8
R(112)=200.*A7+120.*A8
R(113)=200.*A6+120.*A7+420.*A8
R(114)=120.*A5+72.*A6+252.*A7
R(115)=24.*A5+84.*A6
R(116)=R(94)
R(117)=-210.*A8
R(118)=-210.*A7
R(119)=-140.*A6
R(120)=R(98)
R(121)=-48.*A5-6.*A6-8.*A7
R(122)=-6.*A5-8.*A6
R(123)=120.*A5+40.*A6+32.*A7+12.*A8
R(124)=120.*A5+96.*A6+36.*A7+24.*A8
R(125)=96.*A5+36.*A6+24.*A7
R(126)=12.*A5+8.*A6
R(127)=-42.*A6-24.*A7-24.*A8
R(128)=-210.*A5-120.*A6-120.*A7-48.*A8
R(129)=-240.*A5-240.*A6-96.*A7-60.*A8
R(130)=-240.*A5-96.*A6-60.*A7
R(131)=-48.*A5-30.*A6
R(132)=-6.*A5
R(133)=R(89)
R(134)=84.*A7+24.*A8
R(135)=252.*A6+72.*A7+120.*A8
R(136)=420.*A5+120.*A6+200.*A7
R(137)=120.*A5+200.*A6
R(138)=120.*A5
R(139)=R(95)
R(140)=-140.*A7
R(141)=-210.*A6
R(142)=-210.*A5
R(143)=4.*A7
R(144)=4.*A6
R(145)=-16.*A7-6.*A8
R(146)=-48.*A6-18.*A7-48.*A8
R(147)=-48.*A5-18.*A6-48.*A7
R(148)=-6.*A5-16.*A6
R(149)=12.*A7+12.*A8
R(150)=60.*A6+60.*A7+96.*A8
```

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R(151)=120.*A5+120.*A6+192.*A7+120.*A8
R(152)=120.*A5+192.*A6+120.*A7+120.*A8
R(153)=96.*A5+60.*A6+60.*A7
R(154)=12.*A5+12.*A6
R(155)=R(105)
R(156)=-42.*A7-48.*A8
R(157)=-126.*A6-144.*A7-240.*A8
R(158)=-210.*A5-240.*A6-400.*A7-240.*A8
R(159)=-240.*A5-400.*A6-240.*A7-210.*A8
R(160)=-240.*A5-144.*A6-126.*A7
R(161)=-48.*A5-42.*A6
R(162)=R(132)
R(163)=R(111)
R(164)=280.*A7+120.*A8
R(165)=420.*A6+180.*A7+420.*A8
R(166)=420.*A5+180.*A6+420.*A7
R(167)=120.*A5+280.*A6
R(168)=R(138)
R(169)=R(117)
R(170)=-294.*A7
R(171)=-294.*A6
R(172)=R(142)
R(173)=12.*A9+16.*A10+12.
R(174)=16.*A9+12.*A10+24.
R(175)=-20.*A9-16.*A10-24.
R(176)=-48.*A9-72.*A10-48.
R(177)=-72.*A9-48.*A10-60.
R(178)=-16.*A9-20.*A10
R(179)=12.
R(180)=60.*A10+24.
R(181)=120.*A9+48.*A10+120.
R(182)=48.*A9+120.*A10
R(183)=60.*A9
R(184)=-60.
R(185)=-100.*A10
R(186)=-100.*A9
R(187)=-8.*A10-6.
R(188)=-8.*A9-6.*A10-48.
R(189)=8.*A10+12.
R(190)=24.*A9+36.*A10+96.
R(191)=36.*A9+96.*A10+120.
R(192)=32.*A9+40.*A10+120.
R(193)=-6.
R(194)=-30.*A10-48.
R(195)=-60.*A9-96.*A10-240.
R(196)=-96.*A9-240.*A10-240.
R(197)=-120.*A9-120.*A10-210.
R(198)=-24.*A9-42.*A10
R(199)=120.
R(200)=200.*A10+120.
R(201)=200.*A9+120.*A10+420.
R(202)=72.*A9+252.*A10
R(203)=84.*A9
R(204)=-210.
R(205)=-210.*A10
```

```
R(206)=-140.*A9
R(207)=-6.*A9-8.*A10
R(208)=-8.*A9
R(209)=40.*A9+32.*A10+12.
R(210)=96.*A9+36.*A10+24.
R(211)=36.*A9+24.*A10
R(212)=8.*A9
R(213)=-42.*A9-24.*A10-24.
R(214)=-120.*A9-120.*A10-48.
R(215)=-240.*A9-96.*A10-60.
R(216)=-96.*A9-60.*A10
R(217)=-30.*A9
R(218)=R(179)
R(219)=84.*A10+24.
R(220)=252.*A9+72.*A10+120.
R(221)=120.*A9+200.*A10
R(222)=200.*A9
R(223)=R(184)
R(224)=-140.*A10
R(225)=-210.*A9
R(226)=4.*A10
R(227)=4.*A9
R(228)=-16.*A10-6.
R(229)=-48.*A9-18.*A10-48.
R(230)=-18.*A9-48.*A10
R(231)=-16.*A9
R(232)=12.*A10+12.
R(233)=60.*A9+60.*A10+96.
R(234)=120.*A9+192.*A10+120.
R(235)=192.*A9+120.*A10+120.
R(236)=60.*A9+60.*A10
R(237)=12.*A9
R(238)=R(193)
R(239)=-42.*A10-48.
R(240)=-126.*A9-144.*A10-240.
R(241)=-240.*A9-400.*A10-240.
R(242)=-400.*A9-240.*A10-210.
R(243)=-144.*A9-126.*A10
R(244)=-42.*A9
R(245)=R(199)
R(246)=280.*A10+120.
R(247)=420.*A9+180.*A10+420.
R(248)=180.*A9+420.*A10
R(249)=280.*A9
R(250)=R(204)
R(251)=-294.*A10
R(252)=-294.*A9
R(253)=-4.*A9-A10-4.
R(254)=12.*A9+6.*A10+8.
R(255)=12.*A9+16.*A10+12.
R(256)=8.*A9+6.*A10+12.
R(257)=-5.*A10-4.
R(258)=-20.*A9-16.*A10-24.
R(259)=-24.*A9-36.*A10-24.
R(260)=-24.*A9-16.*A10-20.
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R(261)=-4.*A9-5.*A10
R(262)=R(179)
R(263)=30.*A10+12.
R(264)=40.*A9+16.*A10+40.
R(265)=12.*A9+30.*A10
R(266)=R(237)
R(267)=-20.
R(268)=-25.*A10
R(269)=-20.*A9
R(270)=2.
R(271)=-4.
R(272)=-8.*A10-6.
R(273)=-4.*A9-3.*A10-24.
R(274)=R(270)
R(275)=8.*A10+12.
R(276)=12.*A9+18.*A10+48.
R(277)=12.*A9+32.*A10+40.
R(278)=8.*A9+10.*A10+30.
R(279)=R(193)
R(280)=-15.*A10-24.
R(281)=-20.*A9-32.*A10-80.
R(282)=-24.*A9-60.*A10-60.
R(283)=-24.*A9-24.*A10-42.
R(284)=-4.*A9-7.*A10
R(285)=40.
R(286)=50.*A10+30.
R(287)=40.*A9+24.*A10+84.
R(288)=12.*A9+42.*A10
R(289)=R(237)
R(290)=-42.
R(291)=-35.*A10
R(292)=R(269)
R(293)=2.*A9
R(294)=-24.*A9-3.*A10-4.
R(295)=-6.*A9-8.*A10
R(296)=-4.*A9
R(297)=30.*A9+10.*A10+8.
R(298)=40.*A9+32.*A10+12.
R(299)=48.*A9+18.*A10+12.
R(300)=12.*A9+8.*A10
R(301)=R(293)
R(302)=-7.*A10-4.
R(303)=-42.*A9-24.*A10-24.
R(304)=-60.*A9-60.*A10-24.
R(305)=-80.*A9-32.*A10-20.
R(306)=-24.*A9-15.*A10
R(307)=-6.*A9
R(308)=R(179)
R(309)=42.*A10+12.
R(310)=84.*A9+24.*A10+40.
R(311)=30.*A9+50.*A10
R(312)=40.*A9
R(313)=R(267)
R(314)=R(291)
R(315)=R(244)
```

```
R(316)=R(270)
R(317)=R(226)
R(318)=R(293)
R(319)=R(271)
R(320)=-16.*A10-6.
R(321)=-24.*A9-9.*A10-24.
R(322)=-6.*A9-16.*A10
R(323)=R(296)
R(324)=R(270)
R(325)=R(232)
R(326)=30.*A9+30.*A10+48.
R(327)=40.*A9+64.*A10+40.
R(328)=48.*A9+30.*A10+30.
R(329)=12.*A9+12.*A10
R(330)=R(293)
R(331)=R(193)
R(332)=-21.*A10-24.
R(333)=-42.*A9-48.*A10-80.
R(334)=-60.*A9-100.*A10-60.
R(335)=-80.*A9-48.*A10-42.
R(336)=-24.*A9-21.*A10
R(337)=R(307)
R(338)=R(285)
R(339)=70.*A10+30.
R(340)=84.*A9+36.*A10+84.
R(341)=30.*A9+70.*A10
R(342)=R(312)
R(343)=R(290)
R(344)=-49.*A10
R(345)=R(244)
R(346)=-A11-4.*A8
R(347)=6.*A11+8.*A8
R(348)=16.*A11+12.*A8
R(349)=6.*A11+12.*A8
R(350)=-5.*A11-4.*A8
R(351)=-16.*A11-24.*A8
R(352)=-36.*A11-24.*A8
R(353)=-16.*A11-20.*A8
R(354)=-5.*A11
R(355)=R(89)
R(356)=30.*A11+12.*A8
R(357)=16.*A11+40.*A8
R(358)=30.*A11
R(359)=-20.*A8
R(360)=-25.*A11
R(361)=2.*A8
R(362)=-4.*A8
R(363)=-8.*A11-6.*A8
R(364)=-3.*A11-24.*A8
R(365)=R(361)
R(366)=8.*A11+12.*A8
R(367)=18.*A11+48.*A8
R(368)=32.*A11+40.*A8
R(369)=10.*A11+30.*A8
R(370)=-6.*A8
R(371)=-15.*A11-24.*A8
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```
R(372)=-32.*A11-80.*A8
R(373)=-60.*A11-60.*A8
R(374)=-24.*A11-42.*A8
R(375)=-7.*A11
R(376)=40.*A8
R(377)=50.*A11+30.*A8
R(378)=24.*A11+84.*A8
R(379)=42.*A11
R(380)=-42.*A8
R(381)=-35.*A11
R(382)=-3.*A11-4.*A8
R(383)=-8.*A11
R(384)=10.*A11+8.*A8
R(385)=32.*A11+12.*A8
R(386)=18.*A11+12.*A8
R(387)=8.*A11
R(388)=-7.*A11-4.*A8
R(389)=-24.*A11-24.*A8
R(390)=-60.*A11-24.*A8
R(391)=-32.*A11-20.*A8
R(392)=-15.*A11
R(393)=R(89)
R(394)=42.*A11+12.*A8
R(395)=24.*A11+40.*A8
R(396)=50.*A11
R(397)=R(359)
R(398)=R(381)
R(399)=R(361)
R(400)=4.*A11
R(401)=R(362)
R(402)=-16.*A11-6.*A8
R(403)=-9.*A11-24.*A8
R(404)=-16.*A11
R(405)=R(361)
R(406)=12.*A11+12.*A8
R(407)=30.*A11+48.*A8
R(408)=64.*A11+40.*A8
R(409)=30.*A11+30.*A8
R(410)=12.*A11
R(411)=R(370)
R(412)=-21.*A11-24.*A8
R(413)=-48.*A11-80.*A8
R(414)=-100.*A11-60.*A8
R(415)=-48.*A11-42.*A8
R(416)=-21.*A11
R(417)=R(376)
R(418)=70.*A11+30.*A8
R(419)=36.*A11+84.*A8
R(420)=70.*A11
R(421)=R(380)
R(422)=-49.*A11
R(423)=-4.*A9-A10-4.*A12
R(424)=12.*A9+6.*A10+8.*A12
R(425)=12.*A9+16.*A10+12.*A12
R(426)=8.*A9+6.*A10+12.*A12
```

```
R(427)=-5.*A10-4.*A12
R(428)=-20.*A9-16.*A10-24.*A12
R(429)=-24.*A9-36.*A10-24.*A12
R(430)=-24.*A9-16.*A10-20.*A12
R(431)=R(261)
R(432)=12.*A12
R(433)=30.*A10+12.*A12
R(434)=40.*A9+16.*A10+40.*A12
R(435)=R(265)
R(436)=R(237)
R(437)=-20.*A12
R(438)=R(268)
R(439)=R(269)
R(440)=2.*A12
R(441)=-4.*A12
R(442)=-8.*A10-6.*A12
R(443)=-4.*A9-3.*A10-24.*A12
R(444)=R(440)
R(445)=8.*A10+12.*A12
R(446)=12.*A9+18.*A10+48.*A12
R(447)=12.*A9+32.*A10+40.*A12
R(448)=8.*A9+10.*A10+30.*A12
R(449)=-6.*A12
R(450)=-15.*A10-24.*A12
R(451)=-20.*A9-32.*A10-80.*A12
R(452)=-24.*A9-60.*A10-60.*A12
R(453)=-24.*A9-24.*A10-42.*A12
R(454)=R(284)
R(455)=40.*A12
R(456)=50.*A10+30.*A12
R(457)=40.*A9+24.*A10+84.*A12
R(458)=R(288)
R(459)=R(237)
R(460)=-42.*A12
R(461)=R(291)
R(462)=R(269)
R(463)=R(293)
R(464)=-24.*A9-3.*A10-4.*A12
R(465)=R(295)
R(466)=R(296)
R(467)=30.*A9+10.*A10+8.*A12
R(468)=40.*A9+32.*A10+12.*A12
R(469)=48.*A9+18.*A10+12.*A12
R(470)=R(300)
R(471)=R(293)
R(472)=-7.*A10-4.*A12
R(473)=-42.*A9-24.*A10-24.*A12
R(474)=-60.*A9-60.*A10-24.*A12
R(475)=-80.*A9-32.*A10-20.*A12
R(476)=R(306)
R(477)=R(307)
R(478)=R(432)
R(479)=42.*A10+12.*A12
R(480)=84.*A9+24.*A10+40.*A12
R(481)=R(311)
```

```
R(482)=R(312)
R(483)=R(437)
R(484)=R(291)
R(485)=R(244)
R(486)=R(440)
R(487)=R(226)
R(488)=R(293)
R(489)=R(441)
R(490)=-16.*A10-6.*A12
R(491)=-24.*A9-9.*A10-24.*A12
R(492)=R(322)
R(493)=R(296)
R(494)=R(440)
R(495)=12.*A10+12.*A12
R(496)=30.*A9+30.*A10+48.*A12
R(497)=40.*A9+64.*A10+40.*A12
R(498)=48.*A9+30.*A10+30.*A12
R(499)=R(329)
R(500)=R(293)
R(501)=R(449)
R(502)=-21.*A10-24.*A12
R(503)=-42.*A9-48.*A10-80.*A12
R(504)=-60.*A9-100.*A10-60.*A12
R(505)=-80.*A9-48.*A10-42.*A12
R(506)=R(336)
R(507)=R(307)
R(508)=R(455)
R(509)=70.*A10+30.*A12
R(510)=84.*A9+36.*A10+84.*A12
R(511)=R(341)
R(512)=R(312)
R(513)=R(460)
R(514)=R(344)
R(515)=R(244)
Q1=R(1)
Q2=B12*R(253)
Q3=-4.*B12
Q4=B20*R(346)
G(1)=Q1+6.*Q2+YU*Q3+YU*Q4
Q1=R(2)
Q2=B4*R(83)
Q3=B10*R(173)
Q4=B12*R(254)+B13*R(253)
Q5=8.*B12-4.*B18
Q6=B20*R(347)+B21*R(346)
Q7=B13*R(423)
G(2)=Q1+6.*Q2+Z*Q3+6.*Q4+YU*Q5+YU*Q6+YU*Q7
Q1=R(3)+B1*R(1)
Q2=B4*R(84)+B5*R(83)
Q3=B10*R(174)
Q4=B12*R(255)+B14*R(253)
Q5=12.*B12-4.*B14
Q6=B20*R(348)+B22*R(346)
G(3)=Q1+6.*Q2+Z*Q3+6.*Q4+YU*Q5+YU*Q6
Q1=R(4)
```

```
Q2=B5*R(84)
Q3=B12*R(256)+B15*R(253)
Q4=12.*B12-4.*B15
Q5=B20*R(349)
G(4)=Q1+6.*Q2+6.*Q3+YU*Q4+YU*Q5
Q1=R(5)
Q2=B4*R(85)
Q3=B10*R(175)
Q4=B12*R(257)+B13*R(254)
Q5=-4.*B12+8.*B18
Q6=B20*R(350)+B21*R(347)
Q7=B13*R(424)
G(5)=Q1+6.*Q2+Z*Q3+6.*Q4+YU*Q5+YU*Q6+YU*Q7
Q1=R(6)+B1*R(2)
Q2=B4*R(86)+B5*R(85)+B6*R(83)
Q3=B10*R(176)+B11*R(173)
Q4=B12*R(258)+B13*R(255)+B14*R(254)+B3*R(253)
Q5=-24.*B12+12.*B18+8.*B14-4.*B19
Q6=B20*R(351)+B21*R(348)+B22*R(347)+B23*R(346)
Q7=B13*R(425)+B3*R(423)
G(6)=Q1+6.*Q2+Z*Q3+6.*Q4+YU*Q5+YU*Q6+YU*Q7
Q1=R(7)+B1*R(3)+B2*R(1)
Q2=B4*R(87)+B5*R(86)+B6*R(84)+B7*R(83)
Q3=B10*R(177)+B11*R(174)
Q4=B12*R(259)+B13*R(256)+B14*R(255)+B15*R(254)+B16*R(253)
Q5=-24.*B12+12.*B18+12.*B14+8.*B15-4.*B16
Q6=B20*R(352)+B21*R(349)+B22*R(348)+B24*R(346)
Q7=B13*R(426)
G(7)=Q1+6.*Q2+Z*Q3+6.*Q4+YU*Q5+YU*Q6+YU*Q7
Q1=R(8)+B1*R(4)
Q2=B4*R(88)+B5*R(87)+B7*R(84)
Q3=B10*R(178)
Q4=B12*R(260)+B14*R(256)+B15*R(255)+B17*R(253)
Q5=-20.*B12+12.*B14+12.*B15-4.*B17
Q6=B20*R(353)+B22*R(349)
G(8)=Q1+6.*Q2+Z*Q3+6.*Q4+YU*Q5+YU*Q6
Q1=R(9)
Q2=B5*R(88)
Q3=B12*R(261)+B15*R(256)
Q4=12.*B15
Q5=B20*R(354)
G(9)=Q1+6.*Q2+6.*Q3+YU*Q4+YU*Q5
Q1=B4*R(89)
Q2=B10*R(179)
Q3=B13*R(257)
Q4=-4.*B18
Q5=B21*R(350)
Q6=B13*R(427)
G(10)=6.*Q1+Z*Q2+6.*Q3+YU*Q4+YU*Q5+YU*Q6
Q1=R(10)+B1*R(5)
Q2=B4*R(90)+B5*R(89)+B6*R(85)
Q3=B10*R(180)+B11*R(175)
Q4=B12*R(262)+B13*R(258)+B14*R(257)+B3*R(254)
Q5=12.*B12-24.*B18-4.*B14+8.*B19
```

```
      Q6=B20*R(355)+B21*R(351)+B22*R(350)+B23*R(347)
      Q7=B13*R(428)+B3*R(424)
      G(11)=Q1+6.*Q2+Z*Q3+6.*Q4+YU*Q5+YU*Q6+YU*Q7
      Q1=R(11)+B1*R(6)+B2*R(2)
      Q2=B4*R(91)+B5*R(90)+B6*R(86)+B7*R(85)+B8*R(83)
      Q3=B10*R(181)+B11*R(176)+B3*R(173)
      Q4=B12*R(263)+B13*R(259)+B14*R(258)+B15*R(257)+B3*R(255)+
     1B16*R(254)
      Q5=12.*B12-24.*B18-24.*B14-4.*B15+12.*B19+8.*B16
      Q6=B20*R(356)+B21*R(352)+B22*R(351)+B23*R(348)+B24*R(347)
      Q7=B13*R(429)+B3*R(425)
      G(12)=Q1+6.*Q2+Z*Q3+6.*Q4+YU*Q5+YU*Q6+YU*Q7
      Q1=R(12)+B1*R(7)+B2*R(3)+B3*R(1)
      Q2=B4*R(92)+B5*R(91)+B6*R(87)+B7*R(86)+B8*R(84)+B9*R(83)
      Q3=B10*R(182)+B11*R(177)+B3*R(174)
      Q4=B12*R(264)+B13*R(260)+B14*R(259)+B15*R(258)+B3*R(256)+
     1B16*R(255)+B17*R(254)
      Q5=40.*B12-20.*B18-24.*B14-24.*B15+12.*B19+12.*B16+8.*B17
      Q6=B20*R(357)+B21*R(353)+B22*R(352)+B23*R(349)+B24*R(348)
      Q7=B13*R(430)+B3*R(426)
      G(13)=Q1+6.*Q2+Z*Q3+6.*Q4+YU*Q5+YU*Q6+YU*Q7
      Q1=R(13)+B1*R(8)+B2*R(4)
      Q2=B4*R(93)+B5*R(92)+B6*R(88)+B7*R(87)+B9*R(84)
      Q3=B10*R(183)+B11*R(178)
      Q4=B12*R(265)+B13*R(261)+B14*R(260)+B15*R(259)+B16*R(256)+
     1B17*R(255)
      Q5=-20.*B14-24.*B15+12.*B16+12.*B17
      Q6=B20*R(358)+B21*R(354)+B22*R(353)+B24*R(349)
      Q7=B13*R(431)
      G(14)=Q1+6.*Q2+Z*Q3+6.*Q4+YU*Q5+YU*Q6+YU*Q7
      Q1=R(14)+B1*R(9)
      Q2=B4*R(94)+B5*R(93)+B7*R(88)
      Q3=B12*R(266)+B14*R(261)+B15*R(260)+B17*R(256)
      Q4=-20.*B15+12.*B17
      Q5=B22*R(354)
      G(15)=Q1+6.*Q2+6.*Q3+YU*Q4+YU*Q5
      Q1=B5*R(94)
      Q2=B15*R(261)
      G(16)=6.*Q1+6.*Q2
      Q1=B6*R(89)
      Q2=B11*R(179)
      Q3=B13*R(262)+B3*R(257)
      Q4=12.*B18-4.*B19
      Q5=B21*R(355)+B23*R(350)
      Q6=B13*R(432)+B3*R(427)
      G(17)=6.*Q1+Z*Q2+6.*Q3+YU*Q4+YU*Q5+YU*Q6
      Q1=B1*R(10)+B2*R(5)
      Q2=B4*R(95)+B6*R(90)+B7*R(89)+B8*R(85)
      Q3=B10*R(184)+B11*R(180)+B3*R(175)
      Q4=B13*R(263)+B14*R(262)+B3*R(258)+B15*R(257)
      Q5=12.*B18+12.*B14-24.*B19-4.*B16
      Q6=B21*R(356)+B22*R(355)+B23*R(351)+B24*R(350)
      Q7=B13*R(433)+B3*R(428)
      G(18)=Q1+6.*Q2+Z*Q3+6.*Q4+YU*Q5+YU*Q6+YU*Q7
      Q1=B1*R(11)+B2*R(6)+B3*R(2)
```

```
      Q2=B4*R(96)+B5*R(95)+B6*R(91)+B7*R(90)+B8*R(86)+B9*R(85)
      Q3=B10*R(185)+B11*R(181)+B3*R(176)
      Q4=B12*R(267)+B13*R(264)+B14*R(263)+B15*R(262)+B3*R(259)+
     1B16*R(258)+B17*R(257)
      Q5=-20.*B12+40.*B18+12.*B14+12.*B15-24.*B19-24.*B16-4.*B17
      Q6=B20*R(359)+B21*R(357)+B22*R(356)+B23*R(352)+B24*R(351)
      Q7=B13*R(434)+B3*R(429)
      G(19)=Q1+6.*Q2+Z*Q3+6.*Q4+YU*Q5+YU*Q6+YU*Q7
      Q1=B1*R(12)+B2*R(7)+B3*R(3)
      Q2=B4*R(97)+B5*R(96)+B6*R(92)+B7*R(91)+B8*R(87)+B9*R(86)
      Q3=B10*R(186)+B11*R(182)+B3*R(177)
      Q4=B12*R(268)+B13*R(265)+B14*R(264)+B15*R(263)+B3*R(260)+
     1B16*R(259)+B17*R(258)
      Q5=40.*B14+12.*B15-20.*B19-24.*B16-24.*B17
      Q6=B20*R(360)+B21*R(358)+B22*R(357)+B23*R(353)+B24*R(352)
      Q7=B13*R(435)+B3*R(430)
      G(20)=Q1+6.*Q2+Z*Q3+6.*Q4+YU*Q5+YU*Q6+YU*Q7
      Q1=B1*R(13)+B2*R(8)+B3*R(4)
      Q2=B4*R(98)+B5*R(97)+B6*R(93)+B7*R(92)+B8*R(88)+B9*R(87)
      Q3=B11*R(183)+B3*R(178)
      Q4=B12*R(269)+B13*R(266)+B14*R(265)+B15*R(264)+B3*R(261)+
     1B16*R(260)+B17*R(259)
      Q5=40.*B15-20.*B16-24.*B17
      Q6=B22*R(358)+B23*R(354)+B24*R(353)
      Q7=B13*R(436)+B3*R(431)
      G(21)=Q1+6.*Q2+Z*Q3+6.*Q4+YU*Q5+YU*Q6+YU*Q7
      Q1=B1*R(14)+B2*R(9)
      Q2=B5*R(98)+B6*R(94)+B7*R(93)+B9*R(88)
      Q3=B14*R(266)+B15*R(265)+B16*R(261)+B17*R(260)
      Q4=-20.*B17
      Q5=B24*R(354)
      G(22)=Q1+6.*Q2+6.*Q3+YU*Q4+YU*Q5
      Q1=B7*R(94)
      Q2=B15*R(266)+B17*R(261)
      G(23)=6.*Q1+6.*Q2
      Q1=B8*R(89)
      Q2=B3*R(179)
      Q3=B3*R(262)
      Q4=12.*B19
      Q5=B23*R(355)
      Q6=B3*R(432)
      G(24)=6.*Q1+Z*Q2+6.*Q3+YU*Q4+YU*Q5+YU*Q6
      Q1=B2*R(10)+B3*R(5)
      Q2=B6*R(95)+B8*R(90)+B9*R(89)
      Q3=B11*R(184)+B3*R(180)
      Q4=B13*R(267)+B3*R(263)+B16*R(262)
      Q5=-20.*B18+12.*B19+12.*B16
      Q6=B21*R(359)+B23*R(356)+B24*R(355)
      Q7=B13*R(437)+B3*R(433)
      G(25)=Q1+6.*Q2+Z*Q3+6.*Q4+YU*Q5+YU*Q6+YU*Q7
      Q1=B2*R(11)+B3*R(6)
      Q2=B6*R(96)+B7*R(95)+B8*R(91)+B9*R(90)
      Q3=B11*R(185)+B3*R(181)
      Q4=B13*R(268)+B14*R(267)+B3*R(264)+B16*R(263)+B17*R(262)
      Q5=-20.*B14+40.*B19+12.*B16+12.*B17
```

```
      Q6=B21*R(360)+B22*R(359)+B23*R(357)+B24*R(356)
      Q7=B13*R(438)+B3*R(434)
      G(26)=Q1+6.*Q2+Z*Q3+6.*Q4+YU*Q5+YU*Q6+YU*Q7
      Q1=B2*R(12)+B3*R(7)
      Q2=B6*R(97)+B7*R(96)+B8*R(92)+B9*R(91)
      Q3=B11*R(186)+B3*R(182)
      Q4=B13*R(269)+B14*R(268)+B15*R(267)+B3*R(265)+B16*R(264)+
     1B17*R(263)
      Q5=-20.*B15+40.*B16+12.*B17
      Q6=B22*R(360)+B23*R(358)+B24*R(357)
      Q7=B13*R(439)+B3*R(435)
      G(27)=Q1+6.*Q2+Z*Q3+6.*Q4+YU*Q5+YU*Q6+YU*Q7
      Q1=B2*R(13)+B3*R(8)
      Q2=B6*R(98)+B7*R(97)+B8*R(93)+B9*R(92)
      Q3=B3*R(183)
      Q4=B14*R(269)+B15*R(268)+B3*R(266)+B16*R(265)+B17*R(264)
      Q5=40.*B17
      Q6=B24*R(358)
      Q7=B3*R(436)
      G(28)=Q1+6.*Q2+Z*Q3+6.*Q4+YU*Q5+YU*Q6+YU*Q7
      Q1=B2*R(14)+B3*R(9)
      Q2=B7*R(98)+B8*R(94)+B9*R(93)
      Q3=B15*R(269)+B16*R(266)+B17*R(265)
      G(29)=Q1+6.*Q2+6.*Q3
      Q1=B9*R(94)
      Q2=B17*R(266)
      G(30)=6.*Q1+6.*Q2
      Q1=B3*R(10)
      Q2=B8*R(95)
      Q3=B3*R(184)
      Q4=B3*R(267)
      Q5=-20.*B19
      Q6=B23*R(359)
      Q7=B3*R(437)
      G(31)=Q1+6.*Q2+Z*Q3+6.*Q4+YU*Q5+YU*Q6+YU*Q7
      Q1=B3*R(11)
      Q2=B8*R(96)+B9*R(95)
      Q3=B3*R(185)
      Q4=B3*R(268)+B16*R(267)
      Q5=-20.*B16
      Q6=B23*R(360)+B24*R(359)
      Q7=B3*R(438)
      G(32)=Q1+6.*Q2+Z*Q3+6.*Q4+YU*Q5+YU*Q6+YU*Q7
      Q1=B3*R(12)
      Q2=B8*R(97)+B9*R(96)
      Q3=B3*R(186)
      Q4=B3*R(269)+B16*R(268)+B17*R(267)
      Q5=-20.*B17
      Q6=B24*R(360)
      Q7=B3*R(439)
      G(33)=Q1+6.*Q2+Z*Q3+6.*Q4+YU*Q5+YU*Q6+YU*Q7
      Q1=B3*R(13)
      Q2=B8*R(98)+B9*R(97)
      Q3=B16*R(269)+B17*R(268)
      G(34)=Q1+6.*Q2+6.*Q3
      Q1=B3*R(14)
```

```
      Q2=B9*R(98)
      Q3=B17*R(269)
      G(35)=Q1+6.*Q2+6.*Q3
      Q1=R(15)
      Q2=B12*R(270)
      Q3=2.*B12
      Q4=B20*R(361)
      G(36)=Q1+6.*Q2+YU*Q3+YU*Q4
      Q1=R(16)
      Q2=B4*R(99)
      Q3=B10*R(187)
      Q4=B12*R(271)+B13*R(270)
      Q5=-4.*B12+2.*B18
      Q6=B20*R(362)+B21*R(361)
      Q7=B13*R(440)
      G(37)=Q1+6.*Q2+Z*Q3+6.*Q4+YU*Q5+YU*Q6+YU*Q7
      Q1=R(17)+B1*R(15)
      Q2=B4*R(100)+B5*R(99)
      Q3=B10*R(188)
      Q4=B12*R(272)+B14*R(270)
      Q5=-6.*B12+2.*B14
      Q6=B20*R(363)+B22*R(361)
      G(38)=Q1+6.*Q2+Z*Q3+6.*Q4+YU*Q5+YU*Q6
      Q1=R(18)
      Q2=B5*R(100)
      Q3=B12*R(273)+B15*R(270)
      Q4=-24.*B12+2.*B15
      Q5=B20*R(364)
      G(39)=Q1+6.*Q2+6.*Q3+YU*Q4+YU*Q5
      Q1=R(19)
      Q2=B4*R(101)
      Q3=B10*R(189)
      Q4=B12*R(274)+B13*R(271)
      Q5=2.*B12-4.*B18
      Q6=B20*R(365)+B21*R(362)
      Q7=B13*R(441)
      G(40)=Q1+6.*Q2+Z*Q3+6.*Q4+YU*Q5+YU*Q6+YU*Q7
      Q1=R(20)+B1*R(16)
      Q2=B4*R(102)+B5*R(101)+B6*R(99)
      Q3=B10*R(190)+B11*R(187)
      Q4=B12*R(275)+B13*R(272)+B14*R(271)+B3*R(270)
      Q5=12.*B12-6.*B18-4.*B14+2.*B19
      Q6=B20*R(366)+B21*R(363)+B22*R(362)+B23*R(361)
      Q7=B13*R(442)+B3*R(440)
      G(41)=Q1+6.*Q2+Z*Q3+6.*Q4+YU*Q5+YU*Q6+YU*Q7
      Q1=R(21)+B1*R(17)+B2*R(15)
      Q2=B4*R(103)+B5*R(102)+B6*R(100)+B7*R(99)
      Q3=B10*R(191)+B11*R(188)
      Q4=B12*R(276)+B13*R(273)+B14*R(272)+B15*R(271)+B16*R(270)
      Q5=48.*B12-24.*B18-6.*B14-4.*B15+2.*B16
      Q6=B20*R(367)+B21*R(364)+B22*R(363)+B24*R(361)
      Q7=B13*R(443)
      G(42)=Q1+6.*Q2+Z*Q3+6.*Q4+YU*Q5+YU*Q6+YU*Q7
      Q1=R(22)+B1*R(18)
      Q2=B4*R(104)+B5*R(103)+B7*R(100)
```

```
      Q3=B10*R(192)
      Q4=B12*R(277)+B14*R(273)+B15*R(272)+B17*R(270)
      Q5=40.*B12-24.*B14-6.*B15+2.*B17
      Q6=B20*R(368)+B22*R(364)
      G(43)=Q1+6.*Q2+Z*Q3+6.*Q4+YU*Q5+YU*Q6
      Q1=R(23)
      Q2=B5*R(104)
      Q3=B12*R(278)+B15*R(273)
      Q4=30.*B12-24.*B15
      Q5=B20*R(369)
      G(44)=Q1+6.*Q2+6.*Q3+YU*Q4+YU*Q5
      Q1=B4*R(105)
      Q2=B10*R(193)
      Q3=B13*R(274)
      Q4=2.*B18
      Q5=B21*R(365)
      Q6=B13*R(444)
      G(45)=6.*Q1+Z*Q2+6.*Q3+YU*Q4+YU*Q5+YU*Q6
      Q1=R(24)+B1*R(19)
      Q2=B4*R(106)+B5*R(105)+B6*R(101)
      Q3=B10*R(194)+B11*R(189)
      Q4=B12*R(279)+B13*R(275)+B14*R(274)+B3*R(271)
      Q5=-6.*B12+12.*B18+2.*B14-4.*B19
      Q6=B20*R(370)+B21*R(366)+B22*R(365)+B23*R(362)
      Q7=B13*R(445)+B3*R(441)
      G(46)=Q1+6.*Q2+Z*Q3+6.*Q4+YU*Q5+YU*Q6+YU*Q7
      Q1=R(25)+B1*R(20)+B2*R(16)
      Q2=B4*R(107)+B5*R(106)+B6*R(102)+B7*R(101)+B8*R(99)
      Q3=B10*R(195)+B11*R(190)+B3*R(187)
      Q4=B12*R(280)+B13*R(276)+B14*R(275)+B15*R(274)+B3*R(272)+
     1B16*R(271)
      Q5=-24.*B12+48.*B18+12.*B14+2.*B15-6.*B19-4.*B16
      Q6=B20*R(371)+B21*R(367)+B22*R(366)+B23*R(363)+B24*R(362)
      Q7=B13*R(446)+B3*R(442)
      G(47)=Q1+6.*Q2+Z*Q3+6.*Q4+YU*Q5+YU*Q6+YU*Q7
      Q1=R(26)+B1*R(21)+B2*R(17)+B3*R(15)
      Q2=B4*R(108)+B5*R(107)+B6*R(103)+B7*R(102)+B8*R(100)+B9*R(99)
      Q3=B10*R(196)+B11*R(191)+B3*R(188)
      Q4=B12*R(281)+B13*R(277)+B14*R(276)+B15*R(275)+B3*R(273)+
     1B16*R(272)+B17*R(271)
      Q5=-80.*B12+40.*B18+48.*B14+12.*B15-24.*B19-6.*B16-4.*B17
      Q6=B20*R(372)+B21*R(368)+B22*R(367)+B23*R(364)+B24*R(363)
      Q7=B13*R(447)+B3*R(443)
      G(48)=Q1+6.*Q2+Z*Q3+6.*Q4+YU*Q5+YU*Q6+YU*Q7
      Q1=R(27)+B1*R(22)+B2*R(18)
      Q2=B4*R(109)+B5*R(108)+B6*R(104)+B7*R(103)+B9*R(100)
      Q3=B10*R(197)+B11*R(192)
      Q4=B12*R(282)+B13*R(278)+B14*R(277)+B15*R(276)+B16*R(273)+
     1B17*R(272)
      Q5=-60.*B12+30.*B18+40.*B14+48.*B15-24.*B16-6.*B17
      Q6=B20*R(373)+B21*R(369)+B22*R(368)+B24*R(364)
      Q7=B13*R(448)
      G(49)=Q1+6.*Q2+Z*Q3+6.*Q4+YU*Q5+YU*Q6+YU*Q7
      Q1=R(28)+B1*R(23)
      Q2=B4*R(110)+B5*R(109)+B7*R(104)
```

```
      Q3=B10*R(198)
      Q4=B12*R(283)+B14*R(278)+B15*R(277)+B17*R(273)
      Q5=-42.*B12+30.*B14+40.*B15-24.*B17
      Q6=B20*R(374)+B22*R(369)
      G(50)=Q1+6.*Q2+Z*Q3+6.*Q4+YU*Q5+YU*Q6
      Q1=R(29)
      Q2=B5*R(110)
      Q3=B12*R(284)+B15*R(278)
      Q4=30.*B15
      Q5=B20*R(375)
      G(51)=Q1+6.*Q2+6.*Q3+YU*Q4+YU*Q5
      Q1=B6*R(105)
      Q2=B11*R(193)
      Q3=B13*R(279)+B3*R(274)
      Q4=-6.*B18+2.*B19
      Q5=B21*R(370)+B23*R(365)
      Q6=B13*R(449)+B3*R(444)
      G(52)=6.*Q1+Z*Q2+6.*Q3+YU*Q4+YU*Q5+YU*Q6
      Q1=B1*R(24)+B2*R(19)
      Q2=B4*R(111)+B6*R(106)+B7*R(105)+B8*R(101)
      Q3=B10*R(199)+B11*R(194)+B3*R(189)
      Q4=B13*R(280)+B14*R(279)+B3*R(275)+B16*R(274)
      Q5=-24.*B18-6.*B14+12.*B19+2.*B16
      Q6=B21*R(371)+B22*R(370)+B23*R(366)+B24*R(365)
      Q7=B13*R(450)+B3*R(445)
      G(53)=Q1+6.*Q2+Z*Q3+6.*Q4+YU*Q5+YU*Q6+YU*Q7
      Q1=R(30)+B1*R(25)+B2*R(20)+B3*R(16)
      Q2=B4*R(112)+B5*R(111)+B6*R(107)+B7*R(106)+B8*R(102)+B9*R(101)
      Q3=B10*R(200)+B11*R(195)+B3*R(190)
      Q4=B12*R(285)+B13*R(281)+B14*R(280)+B15*R(279)+B3*R(276)+
     1B16*R(275)+B17*R(274)
      Q5=40.*B12-80.*B18-24.*B14-6.*B15+48.*B19+12.*B16+2.*B17
      Q6=B20*R(376)+B21*R(372)+B22*R(371)+B23*R(367)+B24*R(366)
      Q7=B13*R(451)+B3*R(446)
      G(54)=Q1+6.*Q2+Z*Q3+6.*Q4+YU*Q5+YU*Q6+YU*Q7
      Q1=R(31)+B1*R(26)+B2*R(21)+B3*R(17)
      Q2=B4*R(113)+B5*R(112)+B6*R(108)+B7*R(107)+B8*R(103)+B9*R(102)
      Q3=B10*R(201)+B11*R(196)+B3*R(191)
      Q4=B12*R(286)+B13*R(282)+B14*R(281)+B15*R(280)+B3*R(277)+
     1B16*R(276)+B17*R(275)
      Q5=30.*B12-60.*B18-80.*B14-24.*B15+40.*B19+48.*B16+12.*B17
      Q6=B20*R(377)+B21*R(373)+B22*R(372)+B23*R(368)+B24*R(367)
      Q7=B13*R(452)+B3*R(447)
      G(55)=Q1+6.*Q2+Z*Q3+6.*Q4+YU*Q5+YU*Q6+YU*Q7
      Q1=R(32)+B1*R(27)+B2*R(22)+B3*R(18)
      Q2=B4*R(114)+B5*R(113)+B6*R(109)+B7*R(108)+B8*R(104)+B9*R(103)
      Q3=B10*R(202)+B11*R(197)+B3*R(192)
      Q4=B12*R(287)+B13*R(283)+B14*R(282)+B15*R(281)+B3*R(278)+
     1B16*R(277)+B17*R(276)
      Q5=84.*B12-42.*B18-60.*B14-80.*B15+30.*B19+40.*B16+48.*B17
      Q6=B20*R(378)+B21*R(374)+B22*R(373)+B23*R(369)+B24*R(368)
      Q7=B13*R(453)+B3*R(448)
      G(56)=Q1+6.*Q2+Z*Q3+6.*Q4+YU*Q5+YU*Q6+YU*Q7
      Q1=R(33)+B1*R(28)+B2*R(23)
      Q2=B4*R(115)+B5*R(114)+B6*R(110)+B7*R(109)+B9*R(104)
```

```
      Q3=B10*R(203)+B11*R(198)
      Q4=B12*R(288)+B13*R(284)+B14*R(283)+B15*R(282)+B16*R(278)+
     1B17*R(277)
      Q5=-42.*B14-60.*B15+30.*B16+40.*B17
      Q6=B20*R(379)+B21*R(375)+B22*R(374)+B24*R(369)
      Q7=B13*R(454)
      G(57)=Q1+6.*Q2+Z*Q3+6.*Q4+YU*Q5+YU*Q6+YU*Q7
      Q1=R(34)+B1*R(29)
      Q2=B4*R(116)+B5*R(115)+B7*R(110)
      Q3=B12*R(289)+B14*R(284)+B15*R(283)+B17*R(278)
      Q4=-42.*B15+30.*B17
      Q5=B22*R(375)
      G(58)=Q1+6.*Q2+6.*Q3+YU*Q4+YU*Q5
      Q1=B5*R(116)
      Q2=B15*R(284)
      G(59)=6.*Q1+6.*Q2
      Q1=B8*R(105)
      Q2=B3*R(193)
      Q3=B3*R(279)
      Q4=-6.*B19
      Q5=B23*R(370)
      Q6=B3*R(449)
      G(60)=6.*Q1+Z*Q2+6.*Q3+YU*Q4+YU*Q5+YU*Q6
      Q1=B2*R(24)+B3*R(19)
      Q2=B6*R(111)+B8*R(106)+B9*R(105)
      Q3=B11*R(199)+B3*R(194)
      Q4=B13*R(285)+B3*R(280)+B16*R(279)
      Q5=40.*B18-24.*B19-6.*B16
      Q6=B21*R(376)+B23*R(371)+B24*R(370)
      Q7=B13*R(455)+B3*R(450)
      G(61)=Q1+6.*Q2+Z*Q3+6.*Q4+YU*Q5+YU*Q6+YU*Q7
      Q1=B1*R(30)+B2*R(25)+B3*R(20)
      Q2=B4*R(117)+B6*R(112)+B7*R(111)+B8*R(107)+B9*R(106)
      Q3=B10*R(204)+B11*R(200)+B3*R(195)
      Q4=B13*R(286)+B14*R(285)+B3*R(281)+B16*R(280)+B17*R(279)
      Q5=30.*B18+40.*B14-80.*B19-24.*B16-6.*B17
      Q6=B21*R(377)+B22*R(376)+B23*R(372)+B24*R(371)
      Q7=B13*R(456)+B3*R(451)
      G(62)=Q1+6.*Q2+Z*Q3+6.*Q4+YU*Q5+YU*Q6+YU*Q7
      Q1=B1*R(31)+B2*R(26)+B3*R(21)
      Q2=B4*R(118)+B5*R(117)+B6*R(113)+B7*R(112)+B8*R(108)+B9*R(107)
      Q3=B10*R(205)+B11*R(201)+B3*R(196)
      Q4=B12*R(290)+B13*R(287)+B14*R(286)+B15*R(285)+B3*R(282)+
     1B16*R(281)+B17*R(280)
      Q5=-42.*B12+84.*B18+30.*B14+40.*B15-60.*B19-80.*B16-24.*B17
      Q6=B20*R(380)+B21*R(378)+B22*R(377)+B23*R(373)+B24*R(372)
      Q7=B13*R(457)+B3*R(452)
      G(63)=Q1+6.*Q2+Z*Q3+6.*Q4+YU*Q5+YU*Q6+YU*Q7
      Q1=B1*R(32)+B2*R(27)+B3*R(22)
      Q2=B4*R(119)+B5*R(118)+B6*R(114)+B7*R(113)+B8*R(109)+B9*R(108)
      Q3=B10*R(206)+B11*R(202)+B3*R(197)
      Q4=B12*R(291)+B13*R(288)+B14*R(287)+B15*R(286)+B3*R(283)+
     1B16*R(282)+B17*R(281)
      Q5=84.*B14+30.*B15-42.*B19-60.*B16-80.*B17
      Q6=B20*R(381)+B21*R(379)+B22*R(378)+B23*R(374)+B24*R(373)
```

```
      Q7=B13*R(458)+B3*R(453)
      G(64)=Q1+6.*Q2+Z*Q3+6.*Q4+YU*Q5+YU*Q6+YU*Q7
      Q1=B1*R(33)+B2*R(28)+B3*R(23)
      Q2=B4*R(120)+B5*R(119)+B6*R(115)+B7*R(114)+B8*R(110)+B9*R(109)
      Q3=B11*R(203)+B3*R(198)
      Q4=B12*R(292)+B13*R(289)+B14*R(288)+B15*R(287)+B3*R(284)+
     1B16*R(283)+B17*R(282)
      Q5=84.*B15-42.*B16-60.*B17
      Q6=B22*R(379)+B23*R(375)+B24*R(374)
      Q7=B13*R(459)+B3*R(454)
      G(65)=Q1+6.*Q2+Z*Q3+6.*Q4+YU*Q5+YU*Q6+YU*Q7
      Q1=B1*R(34)+B2*R(29)
      Q2=B5*R(120)+B6*R(116)+B7*R(115)+B9*R(110)
      Q3=B14*R(289)+B15*R(288)+B16*R(284)+B17*R(283)
      Q4=-42.*B17
      Q5=B24*R(375)
      G(66)=Q1+6.*Q2+6.*Q3+YU*Q4+YU*Q5
      Q1=B7*R(116)
      Q2=B15*R(289)+B17*R(284)
      G(67)=6.*Q1+6.*Q2
      Q1=B3*R(24)
      Q2=B8*R(111)
      Q3=B3*R(199)
      Q4=B3*R(285)
      Q5=40.*B19
      Q6=B23*R(376)
      Q7=B3*R(455)
      G(68)=Q1+6.*Q2+Z*Q3+6.*Q4+YU*Q5+YU*Q6+YU*Q7
      Q1=B2*R(30)+B3*R(25)
      Q2=B6*R(117)+B8*R(112)+B9*R(111)
      Q3=B11*R(204)+B3*R(200)
      Q4=B13*R(290)+B3*R(286)+B16*R(285)
      Q5=-42.*B18+30.*B19+40.*B16
      Q6=B21*R(380)+B23*R(377)+B24*R(376)
      Q7=B13*R(460)+B3*R(456)
      G(69)=Q1+6.*Q2+Z*Q3+6.*Q4+YU*Q5+YU*Q6+YU*Q7
      Q1=B2*R(31)+B3*R(26)
      Q2=B6*R(118)+B7*R(117)+B8*R(113)+B9*R(112)
      Q3=B11*R(205)+B3*R(201)
      Q4=B13*R(291)+B14*R(290)+B3*R(287)+B16*R(286)+B17*R(285)
      Q5=-42.*B14+84.*B19+30.*B16+40.*B17
      Q6=B21*R(381)+B22*R(380)+B23*R(378)+B24*R(377)
      Q7=B13*R(461)+B3*R(457)
      G(70)=Q1+6.*Q2+Z*Q3+6.*Q4+YU*Q5+YU*Q6+YU*Q7
      Q1=B2*R(32)+B3*R(27)
      Q2=B6*R(119)+B7*R(118)+B8*R(114)+B9*R(113)
      Q3=B11*R(206)+B3*R(202)
      Q4=B13*R(292)+B14*R(291)+B15*R(290)+B3*R(288)+B16*R(287)+
     1B17*R(286)
      Q5=-42.*B15+84.*B16+30.*B17
      Q6=B22*R(381)+B23*R(379)+B24*R(378)
      Q7=B13*R(462)+B3*R(458)
      G(71)=Q1+6.*Q2+Z*Q3+6.*Q4+YU*Q5+YU*Q6+YU*Q7
      Q1=B2*R(33)+B3*R(28)
      Q2=B6*R(120)+B7*R(119)+B8*R(115)+B9*R(114)
```

```
Q3=B3*R(203)
Q4=B14*R(292)+B15*R(291)+B3*R(289)+B16*R(288)+B17*R(287)
Q5=84.*B17
Q6=B24*R(379)
Q7=B3*R(459)
G(72)=Q1+6.*Q2+Z*Q3+6.*Q4+YU*Q5+YU*Q6+YU*Q7
Q1=B2*R(34)+B3*R(29)
Q2=B7*R(120)+B8*R(116)+B9*R(115)
Q3=B15*R(292)+B16*R(289)+B17*R(288)
G(73)=Q1+6.*Q2+6.*Q3
Q1=B9*R(116)
Q2=B17*R(289)
G(74)=6.*Q1+6.*Q2
Q1=B3*R(30)
Q2=B8*R(117)
Q3=B3*R(204)
Q4=B3*R(29 ))
Q5=-42.*B19
Q6=B23*R(380)
Q7=B3*R(460)
G(75)=Q1+6.*Q2+Z*Q3+6.*Q4+YU*Q5+YU*Q6+YU*Q7
Q1=B3*R(31)
Q2=B8*R(118)+B9*R(117)
Q3=B3*R(205)
Q4=B3*R(291)+B16*R(290)
Q5=-42.*B16
Q6=B23*R(381)+B24*R(380)
Q7=B3*R(461)
G(76)=Q1+6.*Q2+Z*Q3+6.*Q4+YU*Q5+YU*Q6+YU*Q7
Q1=B3*R(32)
Q2=B8*R(119)+B9*R(118)
Q3=B3*R(206)
Q4=B3*R(292)+B16*R(291)+B17*R(290)
Q5=-42.*B17
Q6=B24*R(381)
Q7=B3*R'(462)
G(77)=Q1+6.*Q2+Z*Q3+6.*Q4+YU*Q5+YU*Q6+YU*Q7
Q1=B3*R(33)
Q2=B8*R(120)+B9*R(119)
Q3=B16*R(292)+B17*R(291)
G(78)=Q1+6.*Q2+6.*Q3
Q1=B3*R(34)
Q2=B9*R(120)
Q3=B17*R(292)
G(79)=Q1+6.*Q2+6.*Q3
Q1=R(35)
Q2=B12*R(293)
G(80)=Q1+6.*Q2
Q1=R(36)
Q2=B4*R(121)
Q3=B10*R(207)
Q4=B12*R(294)+B13*R(293)
Q5=-4.*B12
Q6=B20*R(382)
Q7=B13*R(463)
G(81)=Q1+6.*Q2+Z*Q3+6.*Q4+YU*Q5+YU*Q6+YU*Q7
```

```
Q1=R(37)+B1*R(35)
Q2=B4*R(122)+B5*R(121)
Q3=B10*R(208)
Q4=B12*R(295)+B14*R(293)
Q5=B20*R(383)
G(82)=Q1+6.*Q2+Z*Q3+6.*Q4+YU*Q5
Q1=R(38)
Q2=B5*R(122)
Q3=B12*R(296)+B15*R(293)
G(83)=Q1+6.*Q2+6.*Q3
Q1=R(39)
Q2=B4*R(123)
Q3=B10*R(209)
Q4=B12*R(297)+B13*R(294)
Q5=8.*B12-4.*B18
Q6=B20*R(384)+B21*R(382)
Q7=B13*R(464)
G(84)=Q1+6.*Q2+Z*Q3+6.*Q4+YU*Q5+YU*Q6+YU*Q7
Q1=R(40)+B1*R(36)
Q2=B4*R(124)+B5*R(123)+B6*R(121)
Q3=B10*R(210)+B11*R(207)
Q4=B12*R(298)+B13*R(295)+B14*R(294)+B3*R(293)
Q5=12.*B12-4.*B14
Q6=B20*R(385)+B21*R(383)+B22*R(382)
Q7=B13*R(465)+B3*R(463)
G(85)=Q1+6.*Q2+Z*Q3+6.*Q4+YU*Q5+YU*Q6+YU*Q7
Q1=R(41)+B1*R(37)+B2*R(35)
Q2=B4*R(125)+B5*R(124)+B6*R(122)+B7*R(121)
Q3=B10*R(211)+B11*R(208)
Q4=B12*R(299)+B13*R(296)+B14*R(295)+B15*R(294)+B16*R(293)
Q5=12.*B12-4.*B15
Q6=B20*R(386)+B22*R(383)
Q7=B13*R(466)
G(86)=Q1+6.*Q2+Z*Q3+6.*Q4+YU*Q5+YU*Q6+YU*Q7
Q1=R(42)+B1*R(38)
Q2=B4*R(126)+B5*R(125)+B7*R(122)
Q3=B10*R(212)
Q4=B12*R(300)+B14*R(296)+B15*R(295)+B17*R(293)
Q5=B20*R(387)
G(87)=Q1+6.*Q2+Z*Q3+6.*Q4+YU*Q5
Q1=R(43)
Q2=B5*R(126)
Q3=B12*R(301)+B15*R(296)
G(88)=Q1+6.*Q2+6.*Q3
Q1=R(44)
Q2=B4*R(127)
Q3=B10*R(213)
Q4=B12*R(302)+B13*R(297)
Q5=-4.*B12+8.*B18
Q6=B20*R(388)+B21*R(384)
Q7=B13*R(467)
G(89)=Q1+6.*Q2+Z*Q3+6.*Q4+YU*Q5+YU*Q6+YU*Q7
Q1=R(45)+B1*R(39)
Q2=B4*R(128)+B5*R(127)+B6*R(123)
Q3=B10*R(214)+B11*R(209)
```

```
      Q4=B12*R(303)+B13*R(298)+B14*R(297)+B3*R(294)
      Q5=-24.*B12+12.*B18+8.*B14-4.*B19
      Q6=B20*R(389)+B21*R(385)+B22*R(384)+B23*R(382)
      Q7=B13*R(468)+B3*R(464)
      G(90)=Q1+6.*Q2+Z*Q3+6.*Q4+YU*Q5+YU*Q6+YU*Q7
      Q1=R(46)+B1*R(40)+B2*R(36)
      Q2=B4*R(129)+B5*R(128)+B6*R(124)+B7*R(123)+B8*R(121)
      Q3=B10*R(215)+B11*R(210)+B3*R(207)
      Q4=B12*R(304)+B13*R(299)+B14*R(298)+B15*R(297)+B3*R(295)+
     1B16*R(294)
      Q5=-24.*B12+12.*B18+12.*B14+8.*B15-4.*B16
      Q6=B20*R(390)+B21*R(386)+B22*R(385)+B23*R(383)+B24*R(382)
      Q7=B13*R(469)+B3*R(465)
      G(91)=Q1+6.*Q2+Z*Q3+6.*Q4+YU*Q5+YU*Q6+YU*Q7
      Q1=R(47)+B1*R(41)+B2*R(37)+B3*R(35)
      Q2=B4*R(130)+B5*R(129)+B6*R(125)+B7*R(124)+B8*R(122)+B9*R(121)
      Q3=B10*R(216)+B11*R(211)+B3*R(208)
      Q4=B12*R(305)+B13*R(300)+B14*R(299)+B15*R(298)+B3*R(296)+
     1B16*R(295)+B17*R(294)
      Q5=-20.*B12+12.*B14+12.*B15-4.*B17
      Q6=B20*R(391)+B21*R(387)+B22*R(386)+B24*R(383)
      Q7=B13*R(470)+B3*R(466)
      G(92)=Q1+6.*Q2+Z*Q3+6.*Q4+YU*Q5+YU*Q6+YU*Q7
      Q1=R(48)+B1*R(42)+B2*R(38)
      Q2=B4*R(131)+B5*R(130)+B6*R(126)+B7*R(125)+B9*R(122)
      Q3=B10*R(217)+B11*R(212)
      Q4=B12*R(306)+B13*R(301)+B14*R(300)+B15*R(299)+B16*R(296)+
     1B17*R(295)
      Q5=12.*B15
      Q6=B20*R(392)+B22*R(387)
      Q7=B13*R(471)
      G(93)=Q1+6.*Q2+Z*Q3+6.*Q4+YU*Q5+YU*Q6+YU*Q7
      Q1=R(49)+B1*R(43)
      Q2=B4*R(132)+B5*R(131)+B7*R(126)
      Q3=B12*R(307)+B14*R(301)+B15*R(300)+B17*R(296)
      G(94)=Q1+6.*Q2+6.*Q3
      Q1=B5*R(132)
      Q2=B15*R(301)
      G(95)=6.*Q1+6.*Q2
      Q1=B4*R(133)
      Q2=B10*R(218)
      Q3=B13*R(302)
      Q4=-4.*B18
      Q5=B21*R(388)
      Q6=B13*R(472)
      G(96)=6.*Q1+Z*Q2+6.*Q3+YU*Q4+YU*Q5+YU*Q6
      Q1=R(50)+B1*R(44)
      Q2=B4*R(134)+B5*R(133)+B6*R(127)
      Q3=B10*R(219)+B11*R(213)
      Q4=B12*R(308)+B13*R(303)+B14*R(302)+B3*R(297)
      Q5=12.*B12-24.*B18-4.*B14+8.*B19
      Q6=B20*R(393)+B21*R(389)+B22*R(388)+B23*R(384)
      Q7=B13*R(473)+B3*R(467)
      G(97)=Q1+6.*Q2+Z*Q3+6.*Q4+YU*Q5+YU*Q6+YU*Q7
      Q1=R(51)+B1*R(45)+B2*R(39)
```

```
      Q2=B4*R(135)+B5*R(134)+B6*R(128)+B7*R(127)+B8*R(123)
      Q3=B10*R(220)+B11*R(214)+B3*R(209)
      Q4=B12*R(309)+B13*R(304)+B14*R(303)+B15*R(302)+B3*R(298)+
     1B16*R(297)
      Q5=12.*B12-24.*B18-24.*B14-4.*B15+12.*B19+8.*B16
      Q6=B20*R(394)+B21*R(390)+B22*R(389)+B23*R(385)+B24*R(384)
      Q7=B13*R(474)+B3*R(468)
      G(98)=Q1+6.*Q2+Z*Q3+6.*Q4+YU*Q5+YU*Q6+YU*Q7
      Q1=R(52)+B1*R(46)+B2*R(40)+B3*R(36)
      Q2=B4*R(136)+B5*R(135)+B6*R(129)+B7*R(128)+B8*R(124)+B9*R(123)
      Q3=B10*R(221)+B11*R(215)+B3*R(210)
      Q4=B12*R(310)+B13*R(305)+B14*R(304)+B15*R(303)+B3*R(299)+
     1B16*R(298)+B17*R(297)
      Q5=40.*B12-20.*B18-24.*B14-24.*B15+12.*B19+12.*B16+8.*B17
      Q6=B20*R(395)+B21*R(391)+B22*R(390)+B23*R(386)+B24*R(385)
      Q7=B13*R(475)+B3*R(469)
      G(99)=Q1+6.*Q2+Z*Q3+6.*Q4+YU*Q5+YU*Q6+YU*Q7
      Q1=R(53)+B1*R(47)+B2*R(41)+B3*R(37)
      Q2=B4*R(137)+B5*R(136)+B6*R(130)+B7*R(129)+B8*R(125)+B9*R(124)
      Q3=B10*R(222)+B11*R(216)+B3*R(211)
      Q4=B12*R(311)+B13*R(306)+B14*R(305)+B15*R(304)+B3*R(300)+
     1B16*R(299)+B17*R(298)
      Q5=-20.*B14-24.*B15+12.*B16+12.*B17
      Q6=B20*R(396)+B21*R(392)+B22*R(391)+B23*R(387)+B24*R(386)
      Q7=B13*R(476)+B3*R(470)
      G(100)=Q1+6.*Q2+Z*Q3+6.*Q4+YU*Q5+YU*Q6+YU*Q7
      Q1=R(54)+B1*R(48)+B2*R(42)+B3*R(38)
      Q2=B4*R(138)+B5*R(137)+B6*R(131)+B7*R(130)+B8*R(126)+B9*R(125)
      Q3=B11*R(217)+B3*R(212)
      Q4=B12*R(312)+B13*R(307)+B14*R(306)+B15*R(305)+B3*R(301)+
     1B16*R(300)+B17*R(299)
      Q5=-20.*B15+12.*B17
      Q6=B22*R(392)+B24*R(387)
      Q7=B13*R(477)+B3*R(471)
      G(101)=Q1+6.*Q2+Z*Q3+6.*Q4+YU*Q5+YU*Q6+YU*Q7
      Q1=B1*R(49)+B2*R(43)
      Q2=B5*R(138)+B6*R(132)+B7*R(131)+B9*R(126)
      Q3=B14*R(307)+B15*R(306)+B16*R(301)+B17*R(300)
      G(102)=Q1+6.*Q2+6.*Q3
      Q1=B7*R(132)
      Q2=B15*R(307)+B17*R(301)
      G(103)=6.*Q1+6.*Q2
      Q1=B6*R(133)
      Q2=B11*R(218)
      Q3=B13*R(308)+B3*R(302)
      Q4=12.*B18-4.*B19
      Q5=B21*R(393)+B23*R(388)
      Q6=B13*R(478)+B3*R(472)
      G(104)=6.*Q1+Z*Q2+6.*Q3+YU*Q4+YU*Q5+YU*Q6
      Q1=B1*R(50)+B2*R(44)
      Q2=B4*R(139)+B6*R(134)+B7*R(133)+B8*R(127)
      Q3=B10*R(223)+B11*R(219)+B3*R(213)
      Q4=B13*R(309)+B14*R(308)+B3*R(303)+B16*R(302)
      Q5=12.*B18+12.*B14-24.*B19-4.*B16
      Q6=B21*R(394)+B22*R(393)+B23*R(389)+B24*R(388)
```

```
      Q7=B13*R(479)+B3*R(473)
      G(105)=Q1+6.*Q2+Z*Q3+6.*Q4+YU*Q5+YU*Q6+YU*Q7
      Q1=B1*R(51)+B2*R(45)+B3*R(39)
      Q2=B4*R(140)+B5*R(139)+B6*R(135)+B7*R(134)+B8*R(128)+B9*R(127)
      Q3=B10*R(224)+B11*R(220)+B3*R(214)
      Q4=B12*R(313)+B13*R(310)+B14*R(309)+B15*R(308)+B3*R(304)+
     1B16*R(303)+B17*R(302)
      Q5=-20.*B12+40.*B18+12.*B14+12.*B15-24.*B19-24.*B16-4.*B17
      Q6=B20*R(397)+B21*R(395)+B22*R(394)+B23*R(390)+B24*R(389)
      Q7=B13*R(480)+B3*R(474)
      G(106)=Q1+6.*Q2+Z*Q3+6.*Q4+YU*Q5+YU*Q6+YU*Q7
      Q1=B1*R(52)+B2*R(46)+B3*R(40)
      Q2=B4*R(141)+B5*R(140)+B6*R(136)+B7*R(135)+B8*R(129)+B9*R(128)
      Q3=B10*R(225)+B11*R(221)+B3*R(215)
      Q4=B12*R(314)+B13*R(311)+B14*R(310)+B15*R(309)+B3*R(305)+
     1B16*R(304)+B17*R(303)
      Q5=40.*B14+12.*B15-20.*B19-24.*B16-24.*B17
      Q6=B20*R(398)+B21*R(396)+B22*R(395)+B23*R(391)+B24*R(390)
      Q7=B13*R(481)+B3*R(475)
      G(107)=Q1+6.*Q2+Z*Q3+6.*Q4+YU*Q5+YU*Q6+YU*Q7
      Q1=B1*R(53)+B2*R(47)+B3*R(41)
      Q2=B4*R(142)+B5*R(141)+B6*R(137)+B7*R(136)+B8*R(130)+B9*R(129)
      Q3=B11*R(222)+B3*R(216)
      Q4=B12*R(315)+B13*R(312)+B14*R(311)+B15*R(310)+B3*R(306)+
     1B16*R(305)+B17*R(304)
      Q5=40.*B15-20.*B16-24.*B17
      Q6=B22*R(396)+B23*R(392)+B24*R(391)
      Q7=B13*R(482)+B3*R(476)
      G(108)=Q1+6.*Q2+Z*Q3+6.*Q4+YU*Q5+YU*Q6+YU*Q7
      Q1=B1*R(54)+B2*R(48)+B3*R(42)
      Q2=B5*R(142)+B6*R(138)+B7*R(137)+B8*R(131)+B9*R(130)
      Q3=B3*R(217)
      Q4=B14*R(312)+B15*R(311)+B3*R(307)+B16*R(306)+B17*R(305)
      Q5=-20.*B17
      Q6=B24*R(392)
      Q7=B3*R(477)
      G(109)=Q1+6.*Q2+Z*Q3+6.*Q4+YU*Q5+YU*Q6+YU*Q7
      Q1=B2*R(49)+B3*R(43)
      Q2=B7*R(138)+B8*R(132)+B9*R(131)
      Q3=B15*R(312)+B16*R(307)+B17*R(306)
      G(110)=Q1+6.*Q2+6.*Q3
      Q1=B9*R(132)
      Q2=B17*R(307)
      G(111)=6.*Q1+6.*Q2
      Q1=B8*R(133)
      Q2=B3*R(218)
      Q3=B3*R(308)
      Q4=12.*B19
      Q5=B23*R(393)
      Q6=B3*R(478)
      G(112)=6.*Q1+Z*Q2+6.*Q3+YU*Q4+YU*Q5+YU*Q6
      Q1=B2*R(50)+B3*R(44)
      Q2=B6*R(139)+B8*R(134)+B9*R(133)
      Q3=B11*R(223)+B3*R(219)
      Q4=B13*R(313)+B3*R(309)+B16*R(308)
```

```
      Q5=-20.*B18+12.*B19+12.*B16
      Q6=B21*R(397)+B23*R(394)+B24*R(393)
      Q7=B13*R(483)+B3*R(479)
      G(113)=Q1+6.*Q2+Z*Q3+6.*Q4+YU*Q5+YU*Q6+YU*Q7
      Q1=B2*R(51)+B3*R(45)
      Q2=B6*R(140)+B7*R(139)+B8*R(135)+B9*R(134)
      Q3=B11*R(224)+B3*R(220)
      Q4=B13*R(314)+B14*R(313)+B3*R(310)+B16*R(309)+B17*R(308)
      Q5=-20.*B14+40.*B19+12.*B16+12.*B17
      Q6=B21*R(398)+B22*R(397)+B23*R(395)+B24*R(394)
      Q7=B13*R(484)+B3*R(480)
      G(114)=Q1+6.*Q2+Z*Q3+6.*Q4+YU*Q5+YU*Q6+YU*Q7
      Q1=B2*R(52)+B3*R(46)
      Q2=B6*R(141)+B7*R(140)+B8*R(136)+B9*R(135)
      Q3=B11*R(225)+B3*R(221)
      Q4=B13*R(315)+B14*R(314)+B15*R(313)+B3*R(311)+B16*R(310)+
     1B17*R(309)
      Q5=-20.*B15+40.*B16+12.*B17
      Q6=B22*R(398)+B23*R(396)+B24*R(395)
      Q7=B13*R(485)+B3*R(481)
      G(115)=Q1+6.*Q2+Z*Q3+6.*Q4+YU*Q5+YU*Q6+YU*Q7
      Q1=B2*R(53)+B3*R(47)
      Q2=B6*R(142)+B7*R(141)+B8*R(137)+B9*R(136)
      Q3=B3*R(222)
      Q4=B14*R(315)+B15*R(314)+B3*R(312)+B16*R(311)+B17*R(310)
      Q5=40.*B17
      Q6=B24*R(396)
      Q7=B3*R(482)
      G(116)=Q1+6.*Q2+Z*Q3+6.*Q4+YU*Q5+YU*Q6+YU*Q7
      Q1=B2*R(54)+B3*R(48)
      Q2=B7*R(142)+B8*R(138)+B9*R(137)
      Q3=B15*R(315)+B16*R(312)+B17*R(311)
      G(117)=Q1+6.*Q2+6.*Q3
      Q1=B3*R(49)
      Q2=B9*R(138)
      Q3=B17*R(312)
      G(118)=Q1+6.*Q2+6.*Q3
      Q1=B3*R(50)
      Q2=B8*R(139)
      Q3=B3*R(223)
      Q4=B3*R(313)
      Q5=-20.*B19
      Q6=B23*R(397)
      Q7=B3*R(483)
      G(119)=Q1+6.*Q2+Z*Q3+6.*Q4+YU*Q5+YU*Q6+YU*Q7
      Q1=B3*R(51)
      Q2=B8*R(14 ))+B9*R(139)
      Q3=B3*R(224)
      Q4=B3*R(314)+B16*R(313)
      Q5=-20.*B16
      Q6=B23*R(398)+B24*R(397)
      Q7=B3*R(484)
      G(120)=Q1+6.*Q2+Z*Q3+6.*Q4+YU*Q5+YU*Q6+YU*Q7
      Q1=B3*R(52)
      Q2=B8*R(141)+B9*R(140)
```

```
      Q3=B3*R(225)
      Q4=B3*R(315)+B16*R(314)+B17*R(313)
      Q5=-20.*B17
      Q6=B24*R(398)
      Q7=B3*R(485)
      G(121)=Q1+6.*Q2+Z*Q3+6.*Q4+YU*Q5+YU*Q6+YU*Q7
      Q1=B3*R(53)
      Q2=B8*R(142)+B9*R(141)
      Q3=B16*R(315)+B17*R(314)
      G(122)=Q1+6.*Q2+6.*Q3
      Q1=B3*R(54)
      Q2=B9*R(142)
      Q3=B17*R(315)
      G(123)=Q1+6.*Q2+6.*Q3
      G(124)=R(55)
      Q1=R(56)
      Q2=B4*R(143)
      Q3=B10*R(226)
      Q4=B12*R(316)
      Q5=2.*B12
      Q6=B20*R(399)
      G(125)=Q1+6.*Q2+Z*Q3+6.*Q4+YU*Q5+YU*Q6
      Q1=R(57)+B1*R(55)
      Q2=B4*R(144)+B5*R(143)
      Q3=B10*R(227)
      Q4=B12*R(317)
      Q5=B20*R(400)
      G(126)=Q1+6.*Q2+Z*Q3+6.*Q4+YU*Q5
      Q1=R(58)
      Q2=B5*R(144)
      Q3=B12*R(318)
      G(127)=Q1+6.*Q2+6.*Q3
      Q1=R(59)
      Q2=B4*R(145)
      Q3=B10*R(228)
      Q4=B12*R(319)+B13*R(316)
      Q5=-4.*B12+2.*B18
      Q6=B20*R(401)+B21*R(399)
      Q7=B13*R(486)
      G(128)=Q1+6.*Q2+Z*Q3+6.*Q4+YU*Q5+YU*Q6+YU*Q7
      Q1=R(60)+B1*R(56)
      Q2=B4*R(146)+B5*R(145)+B6*R(143)
      Q3=B10*R(229)+B11*R(226)
      Q4=B12*R(320)+B13*R(317)+B14*R(316)
      Q5=-6.*B12+2.*B14
      Q6=B20*R(402)+B21*R(400)+B22*R(399)
      Q7=B13*R(487)
      G(129)=Q1+6.*Q2+Z*Q3+6.*Q4+YU*Q5+YU*Q6+YU*Q7
      Q1=R(61)+B1*R(57)+B2*R(55)
      Q2=B4*R(147)+B5*R(146)+B6*R(144)+B7*R(143)
      Q3=B10*R(230)+B11*R(227)
      Q4=B12*R(321)+B13*R(319)+B14*R(317)+B15*R(316)
      Q5=-24.*B12+2.*B15
      Q6=B20*R(403)+B22*R(400)
      Q7=B13*R(488)
```

```
      G(130)=Q1+6.*Q2+Z*Q3+6.*Q4+YU*Q5+YU*Q6+YU*Q7
      Q1=R(62)+B1*R(58)
      Q2=B4*R(148)+B5*R(147)+B7*R(144)
      Q3=B10*R(231)
      Q4=B12*R(322)+B14*R(318)+B15*R(317)
      Q5=B20*R(404)
      G(131)=Q1+6.*Q2+Z*Q3+6.*Q4+YU*Q5
      Q1=R(63)
      Q2=B5*R(148)
      Q3=B12*R(323)+B15*R(318)
      G(132)=Q1+6.*Q2+6.*Q3
      Q1=R(64)
      Q2=B4*R(149)
      Q3=B10*R(232)
      Q4=B12*R(324)+B13*R(319)
      Q5=2.*B12-4.*B18
      Q6=B20*R(405)+B21*R(401)
      Q7=B13*R(489)
      G(133)=Q1+6.*Q2+Z*Q3+6.*Q4+YU*Q5+YU*Q6+YU*Q7
      Q1=R(65)+B1*R(59)
      Q2=B4*R(150)+B5*R(149)+B6*R(145)
      Q3=B10*R(233)+B11*R(228)
      Q4=B12*R(325)+B13*R(320)+B14*R(319)+B3*R(316)
      Q5=12.*B12-6.*B18-4.*B14+2.*B19
      Q6=B20*R(406)+B21*R(402)+B22*R(401)+B23*R(399)
      Q7=B13*R(490)+B3*R(486)
      G(134)=Q1+6.*Q2+Z*Q3+6.*Q4+YU*Q5+YU*Q6+YU*Q7
      Q1=R(66)+B1*R(60)+B2*R(56)
      Q2=B4*R(151)+B5*R(150)+B6*R(146)+B7*R(145)+B8*R(143)
      Q3=B10*R(234)+B11*R(229)+B3*R(226)
      Q4=B12*R(326)+B13*R(321)+B14*R(320)+B15*R(319)+B3*R(317)+
     1B16*R(316)
      Q5=48.*B12-24.*B18-6.*B14-4.*B15+2.*B16
      Q6=B20*R(407)+B21*R(403)+B22*R(402)+B23*R(400)+B24*R(399)
      Q7=B13*R(491)+B3*R(487)
      G(135)=Q1+6.*Q2+Z*Q3+6.*Q4+YU*Q5+YU*Q6+YU*Q7
      Q1=R(67)+B1*R(61)+B2*R(57)+B3*R(55)
      Q2=B4*R(152)+B5*R(151)+B6*R(147)+B7*R(146)+B8*R(144)+B9*R(143)
      Q3=B10*R(235)+B11*R(230)+B3*R(227)
      Q4=B12*R(327)+B13*R(322)+B14*R(321)+B15*R(320)+B3*R(318)+
     1B16*R(317)+B17*R(316)
      Q5=40.*B12-24.*B14-6.*B15+2.*B17
      Q6=B20*R(408)+B21*R(404)+B22*R(403)+B24*R(400)
      Q7=B13*R(492)+B3*R(488)
      G(136)=Q1+6.*Q2+Z*Q3+6.*Q4+YU*Q5+YU*Q6+YU*Q7
      Q1=R(68)+B1*R(62)+B2*R(58)
      Q2=B4*R(153)+B5*R(152)+B6*R(148)+B7*R(147)+B9*R(144)
      Q3=B10*R(236)+B11*R(231)
      Q4=B12*R(328)+B13*R(323)+B14*R(322)+B15*R(321)+B16*R(318)+
     1B17*R(317)
      Q5=30.*B12-24.*B15
      Q6=B20*R(409)+B22*R(404)
      Q7=B13*R(493)
      G(137)=Q1+6.*Q2+Z*Q3+6.*Q4+YU*Q5+YU*Q6+YU*Q7
      Q1=R(69)+B1*R(63)
```

```
      Q2=B4*R(154)+B5*R(153)+B7*R(148)
      Q3=B10*R(237)
      Q4=B12*R(329)+B14*R(323)+B15*R(322)+B17*R(318)
      Q5=B20*R(410)
      G(138)=Q1+6.*Q2+Z*Q3+6.*Q4+YU*Q5
      Q1=R(70)
      Q2=B5*R(154)
      Q3=B12*R(330)+B15*R(323)
      G(139)=Q1+6.*Q2+6.*Q3
      Q1=B4*R(155)
      Q2=B10*R(238)
      Q3=B13*R(324)
      Q4=2.*B18
      Q5=B21*R(405)
      Q6=B13*R(494)
      G(140)=6.*Q1+Z*Q2+6.*Q3+YU*Q4+YU*Q5+YU*Q6
      Q1=R(71)+E1*R(64)
      Q2=B4*R(156)+B5*R(155)+B6*R(149)
      Q3=B10*R(239)+B11*R(232)
      Q4=B12*R(331)+B13*R(325)+B14*R(324)+B3*R(319)
      Q5=-6.*B12+12.*B18+2.*B14-4.*B19
      Q6=B20*R(411)+B21*R(406)+B22*R(405)+B23*R(401)
      Q7=B13*R(495)+B3*R(489)
      G(141)=Q1+6.*Q2+Z*Q3+6.*Q4+YU*Q5+YU*Q6+YU*Q7
      Q1=R(72)+B1*R(65)+B2*R(59)
      Q2=B4*R(157)+B5*R(156)+B6*R(150)+B7*R(149)+B8*R(145)
      Q3=B10*R(240)+B11*R(233)+B3*R(228)
      Q4=B12*R(332)+B13*R(326)+B14*R(325)+B15*R(324)+B3*R(320)+
     1B16*R(319)
      Q5=-24.*B12+48.*B18+12.*B14+2.*B15-6.*B19-4.*B16
      Q6=B20*R(412)+B21*R(407)+B22*R(406)+B23*R(402)+B24*R(401)
      Q7=B13*R(496)+B3*R(490)
      G(142)=Q1+6.*Q2+Z*Q3+6.*Q4+YU*Q5+YU*Q6+YU*Q7
      Q1=R(73)+B1*R(66)+B2*R(60)+B3*R(56)
      Q2=B4*R(158)+B5*R(157)+B6*R(151)+B7*R(150)+B8*R(146)+B9*R(145)
      Q3=B10*R(241)+B11*R(234)+B3*R(229)
      Q4=B12*R(333)+B13*R(327)+B14*R(326)+B15*R(325)+B3*R(321)+
     1B16*R(320)+B17*R(319)
      Q5=-80.*B12+40.*B18+48.*B14+12.*B15-24.*B19-6.*B16-4.*B17
      Q6=B20*R(413)+B21*R(408)+B22*R(407)+B23*R(403)+B24*R(402)
      Q7=B13*R(497)+B3*R(491)
      G(143)=Q1+6.*Q2+Z*Q3+6.*Q4+YU*Q5+YU*Q6+YU*Q7
      Q1=R(74)+B1*R(67)+B2*R(61)+B3*R(57)
      Q2=B4*R(159)+B5*R(158)+B6*R(152)+B7*R(151)+B8*R(147)+B9*R(146)
      Q3=B10*R(242)+B11*R(235)+B3*R(230)
      Q4=B12*R(334)+B13*R(328)+B14*R(327)+B15*R(326)+B3*R(322)+
     1B16*R(321)+B17*R(320)
      Q5=-60.*B12+30.*B18+40.*B14+48.*B15-24.*B16-6.*B17
      Q6=B20*R(414)+B21*R(409)+B22*R(408)+B23*R(404)+B24*R(403)
      Q7=B13*R(498)+B3*R(492)
      G(144)=Q1+6.*Q2+Z*Q3+6.*Q4+YU*Q5+YU*Q6+YU*Q7
      Q1=R(75)+B1*R(68)+B2*R(62)+B3*R(58)
      Q2=B4*R(160)+B5*R(159)+B6*R(153)+B7*R(152)+B8*R(148)+B9*R(147)
      Q3=B10*R(243)+B11*R(236)+B3*R(231)
      Q4=B12*R(335)+B13*R(329)+B14*R(328)+B15*R(327)+B3*R(323)+
     1B16*R(322)+B17*R(321)
```

```
      Q5=-42.*B12+30.*B14+40.*B15-24.*B17
      Q6=B20*R(415)+B21*R(410)+B22*R(409)+B24*R(404)
      Q7=B13*R(499)+B3*R(493)
      G(145)=Q1+6.*Q2+Z*Q3+6.*Q4+YU*Q5+YU*Q6+YU*Q7
      Q1=R(76)+B1*R(69)+B2*R(63)
      Q2=B4*R(161)+B5*R(160)+B6*R(154)+B7*R(153)+B9*R(148)
      Q3=B10*R(244)+B11*R(237)
      Q4=B12*R(336)+B13*R(330)+B14*R(329)+B15*R(328)+B16*R(323)+
     1B17*R(322)
      Q5=30.*B15
      Q6=B20*R(416)+B22*R(410)
      Q7=B13*R(500)
      G(146)=Q1+6.*Q2+Z*Q3+6.*Q4+YU*Q5+YU*Q6+YU*Q7
      Q1=R(77)+B1*R(70)
      Q2=B4*R(162)+B5*R(161)+B7*R(154)
      Q3=B12*R(337)+B14*R(330)+B15*R(329)+B17*R(323)
      G(147)=Q1+6.*Q2+6.*Q3
      Q1=B5*R(162)
      Q2=B15*R(330)
      G(148)=6.*Q1+6.*Q2
      Q1=B6*R(155)
      Q2=B11*R(238)
      Q3=B13*R(331)+B3*R(324)
      Q4=-6.*B18+2.*B19
      Q5=B21*R(411)+B23*R(405)
      Q6=B13*R(501)+B3*R(494)
      G(149)=6.*Q1+Z*Q2+6.*Q3+YU*Q4+YU*Q5+YU*Q6
      Q1=B1*R(71)+B2*R(64)
      Q2=B4*R(163)+B6*R(156)+B7*R(155)+B8*R(149)
      Q3=B10*R(245)+B11*R(239)+B3*R(232)
      Q4=B13*R(332)+B14*R(331)+B3*R(325)+B16*R(324)
      Q5=-24.*B18-6.*B14+12.*B19+2.*B16
      Q6=B21*R(412)+B22*R(411)+B23*R(406)+B24*R(405)
      Q7=B13*R(502)+B3*R(495)
      G(150)=Q1+6.*Q2+Z*Q3+6.*Q4+YU*Q5+YU*Q6+YU*Q7
      Q1=R(78)+B1*R(72)+B2*R(65)+B3*R(59)
      Q2=B4*R(164)+B5*R(163)+B6*R(157)+B7*R(156)+B8*R(150)+B9*R(149)
      Q3=B10*R(246)+B11*R(240)+B3*R(233)
      Q4=B12*R(338)+B13*R(333)+B14*R(332)+B15*R(331)+B3*R(326)+
     1B16*R(325)+B17*R(324)
      Q5=40.*B12-80.*B18-24.*B14-6.*B15+48.*B19+12.*B16+2.*B17
      Q6=B20*R(417)+B21*R(413)+B22*R(412)+B23*R(407)+B24*R(406)
      Q7=B13*R(503)+B3*R(496)
      G(151)=Q1+6.*Q2+Z*Q3+6.*Q4+YU*Q5+YU*Q6+YU*Q7
      Q1=R(79)+B1*R(73)+B2*R(66)+B3*R(60)
      Q2=B4*R(165)+B5*R(164)+B6*R(158)+B7*R(157)+B8*R(151)+B9*R(150)
      Q3=B10*R(247)+B11*R(241)+B3*R(234)
      Q4=B12*R(339)+B13*R(334)+B14*R(333)+B15*R(332)+B3*R(327)+
     1B16*R(326)+B17*R(325)
      Q5=30.*B12-60.*B18-80.*B14-24.*B15+40.*B19+48.*B16+12.*B17
      Q6=B20*R(418)+B21*R(414)+B22*R(413)+B23*R(408)+B24*R(407)
      Q7=B13*R(504)+B3*R(497)
      G(152)=Q1+6.*Q2+Z*Q3+6.*Q4+YU*Q5+YU*Q6+YU*Q7
      Q1=R(80)+B1*R(74)+B2*R(67)+B3*R(61)
      Q2=B4*R(166)+B5*R(165)+B6*R(159)+B7*R(158)+B8*R(152)+B9*R(151)
```

```
      Q3=B10*R(248)+B11*R(242)+B3*R(235)
      Q4=B12*R(340)+B13*R(335)+B14*R(334)+B15*R(333)+B3*R(328)+
     1B16*R(327)+B17*R(326)
      Q5=84.*B12-42.*B18-60.*B14-80.*B15+30.*B19+40.*B16+48.*B17
      Q6=B20*R(419)+B21*R(415)+B22*R(414)+B23*R(409)+B24*R(408)
      Q7=B13*R(505)+B3*R(498)
      G(153)=Q1+6.*Q2+Z*Q3+6.*Q4+YU*Q5+YU*Q6+YU*Q7
      Q1=R(81)+B1*R(75)+B2*R(68)+B3*R(62)
      Q2=B4*R(167)+B5*R(166)+B6*R(160)+B7*R(159)+B8*R(153)+B9*R(152)
      Q3=B10*R(249)+B11*R(243)+B3*R(236)
      Q4=B12*R(341)+B13*R(336)+B14*R(335)+B15*R(334)+B3*R(329)+
     1B16*R(328)+B17*R(327)
      Q5=-42.*B14-60.*B15+30.*B16+40.*B17
      Q6=B20*R(420)+B21*R(416)+B22*R(415)+B23*R(410)+B24*R(409)
      Q7=B13*R(506)+B3*R(499)
      G(154)=Q1+6.*Q2+Z*Q3+6.*Q4+YU*Q5+YU*Q6+YU*Q7
      Q1=R(82)+B1*R(76)+B2*R(69)+B3*R(63)
      Q2=B4*R(168)+B5*R(167)+B6*R(161)+B7*R(160)+B8*R(154)+B9*R(153)
      Q3=B11*R(244)+B3*R(237)
      Q4=B12*R(342)+B13*R(337)+B14*R(336)+B15*R(335)+B3*R(330)+
     1B16*R(329)+B17*R(328)
      Q5=-42.*B15+30.*B17
      Q6=B22*R(416)+B24*R(410)
      Q7=B13*R(507)+B3*R(500)
      G(155)=Q1+6.*Q2+Z*Q3+6.*Q4+YU*Q5+YU*Q6+YU*Q7
      Q1=B1*R(77)+B2*R(70)
      Q2=B5*R(168)+B6*R(162)+B7*R(161)+B9*R(154)
      Q3=B14*R(337)+B15*R(336)+B16*R(330)+B17*R(329)
      G(156)=Q1+6.*Q2+6.*Q3
      Q1=B7*R(162)
      Q2=B15*R(337)+B17*R(330)
      G(157)=6.*Q1+6.*Q2
      Q1=B8*R(155)
      Q2=B3*R(238)
      Q3=B3*R(331)
      Q4=-6.*B19
      Q5=B23*R(411)
      Q6=B3*R(501)
      G(158)=6.*Q1+Z*Q2+6.*Q3+YU*Q4+YU*Q5+YU*Q6
      Q1=B2*R(71)+B3*R(64)
      Q2=B6*R(163)+B8*R(156)+B9*R(155)
      Q3=B11*R(245)+B3*R(239)
      Q4=B13*R(338)+B3*R(332)+B16*R(331)
      Q5=40.*B18-24.*B19-6.*B16
      Q6=B21*R(417)+B23*R(412)+B24*R(411)
      Q7=B13*R(508)+B3*R(502)
      G(159)=Q1+6.*Q2+Z*Q3+6.*Q4+YU*Q5+YU*Q6+YU*Q7
      Q1=B1*R(78)+B2*R(72)+B3*R(65)
      Q2=B4*R(169)+B6*R(164)+B7*R(163)+B8*R(157)+B9*R(156)
      Q3=B10*R(250)+B11*R(246)+B3*R(240)
      Q4=B13*R(339)+B14*R(338)+B3*R(333)+B16*R(332)+B17*R(331)
      Q5=30.*B18+40.*B14-80.*B19-24.*B16-6.*B17
      Q6=B21*R(418)+B22*R(417)+B23*R(413)+B24*R(412)
      Q7=B13*R(509)+B3*R(503)
      G(160)=Q1+6.*Q2+Z*Q3+6.*Q4+YU*Q5+YU*Q6+YU*Q7
      Q1=B1*R(79)+B2*R(73)+B3*R(66)
      Q2=B4*R(170)+B5*R(169)+B6*R(165)+B7*R(164)+B8*R(158)+B9*R(157)
      Q3=B10*R(251)+B11*R(247)+B3*R(241)
```

```
      Q4=B12*R(343)+B13*R(340)+B14*R(339)+B15*R(338)+B3*R(334)+
     1B16*R(333)+B17*R(332)
      Q5=-42.*B12+84.*B18+30.*B14+40.*B15-60.*B19-80.*B16-24.*B17
      Q6=B20*R(421)+B21*R(419)+B22*R(418)+B23*R(414)+B24*R(413)
      Q7=B13*R(510)+B3*R(504)
      G(161)=Q1+6.*Q2+Z*Q3+6.*Q4+YU*Q5+YU*Q6+YU*Q7
      Q1=B1*R(80)+B2*R(74)+B3*R(67)
      Q2=B4*R(171)+B5*R(170)+B6*R(166)+B7*R(165)+B8*R(159)+B9*R(158)
      Q3=B10*R(252)+B11*R(248)+B3*R(242)
      Q4=B12*R(344)+B13*R(341)+B14*R(340)+B15*R(339)+B3*R(335)+
     1B16*R(334)+B17*R(333)
      Q5=84.*B14+30.*B15-42.*B19-60.*B16-80.*B17
      Q6=B20*R(422)+B21*R(420)+B22*R(419)+B23*R(415)+B24*R(414)
      Q7=B13*R(511)+B3*R(505)
      G(162)=Q1+6.*Q2+Z*Q3+6.*Q4+YU*Q5+YU*Q6+YU*Q7
      Q1=B1*R(81)+B2*R(75)+B3*R(68)
      Q2=B4*R(172)+B5*R(171)+B6*R(167)+B7*R(166)+B8*R(160)+B9*R(159)
      Q3=B11*R(249)+B3*R(243)
      Q4=B12*R(345)+B13*R(342)+B14*R(341)+B15*R(340)+B3*R(336)+
     1B16*R(335)+B17*R(334)
      Q5=84.*B15-42.*B16-60.*B17
      Q6=B22*R(420)+B23*R(416)+B24*R(415)
      Q7=B13*R(512)+B3*R(506)
      G(163)=Q1+6.*Q2+Z*Q3+6.*Q4+YU*Q5+YU*Q6+YU*Q7
      Q1=B1*R(82)+B2*R(76)+B3*R(69)
      Q2=B5*R(172)+B6*R(168)+B7*R(167)+B8*R(161)+B9*R(160)
      Q3=B3*R(244)
      Q4=B14*R(342)+B15*R(341)+B3*R(337)+B16*R(336)+B17*R(335)
      Q5=-42.*B17
      Q6=B24*R(416)
      Q7=B3*R(507)
      G(164)=Q1+6.*Q2+Z*Q3+6.*Q4+YU*Q5+YU*Q6+YU*Q7
      Q1=B2*R(77)+B3*R(70)
      Q2=B7*R(168)+B8*R(162)+B9*R(161)
      Q3=B15*R(342)+B16*R(337)+B17*R(336)
      G(165)=Q1+6.*Q2+6.*Q3
      Q1=B9*R(162)
      Q2=B17*R(337)
      G(166)=6.*Q1+6.*Q2
      Q1=B3*R(71)
      Q2=B8*R(163)
      Q3=B3*R(245)
      Q4=B3*R(338)
      Q5=40.*B19
      Q6=B23*R(417)
      Q7=B3*R(508)
      G(167)=Q1+6.*Q2+Z*Q3+6.*Q4+YU*Q5+YU*Q6+YU*Q7
      Q1=B2*R(78)+B3*R(72)
      Q2=B6*R(169)+B8*R(164)+B9*R(163)
      Q3=B11*R(250)+B3*R(246)
      Q4=B13*R(343)+B3*R(339)+B16*R(338)
      Q5=-42.*B19+30.*B19+40.*B16
      Q6=B21*R(421)+B23*R(418)+B24*R(417)
      Q7=B13*R(513)+B3*R(509)
      G(168)=Q1+6.*Q2+Z*Q3+6.*Q4+YU*Q5+YU*Q6+YU*Q7
```

```
      Q1=B2*R(79)+B3*R(73)
      Q2=B6*R(170)+B7*R(169)+B8*R(165)+B9*R(164)
      Q3=B11*R(251)+B3*R(247)
      Q4=B13*R(344)+B14*R(343)+B3*R(340)+B16*R(339)+B17*R(338)
      Q5=-42.*B14+84.*B19+30.*B16+40.*B17
      Q6=B21*R(422)+B22*R(421)+B23*R(419)+B24*R(418)
      Q7=B13*R(514)+B3*R(510)
      G(169)=Q1+6.*Q2+Z*Q3+6.*Q4+YU*Q5+YU*Q6+YU*Q7
      Q1=B2*R(80)+B3*R(74)
      Q2=B6*R(171)+B7*R(170)+B8*R(166)+B9*R(165)
      Q3=B11*R(252)+B3*R(248)
      Q4=B13*R(345)+B14*R(344)+B15*R(343)+B3*R(341)+B16*R(340)+
     1B17*R(339)
      Q5=-42.*B15+84.*B16+30.*B17
      Q6=B22*R(422)+B23*R(420)+B24*R(419)
      Q7=B13*R(515)+B3*R(511)
      G(170)=Q1+6.*Q2+Z*Q3+6.*Q4+YU*Q5+YU*Q6+YU*Q7
      Q1=B2*R(81)+B3*R(75)
      Q2=B6*R(172)+B7*R(171)+B8*R(167)+B9*R(166)
      Q3=B3*R(249)
      Q4=B14*R(345)+B15*R(344)+B3*R(342)+B16*R(341)+B17*R(340)
      Q5=84.*B17
      Q6=B24*R(420)
      Q7=B3*R(512)
      G(171)=Q1+6.*Q2+Z*Q3+6.*Q4+YU*Q5+YU*Q6+YU*Q7
      Q1=B2*R(82)+B3*R(76)
      Q2=B7*R(172)+B8*R(168)+B9*R(167)
      Q3=B15*R(345)+B16*R(342)+B17*R(341)
      G(172)=Q1+6.*Q2+6.*Q3
      Q1=B3*R(77)
      Q2=B9*R(168)
      Q3=B17*R(342)
      G(173)=Q1+6.*Q2+6.*Q3
      Q1=B3*R(78)
      Q2=B8*R(169)
      Q3=B3*R(250)
      Q4=B3*R(343)
      Q5=-42.*B19
      Q6=B23*R(421)
      Q7=B3*R(513)
      G(174)=Q1+6.*Q2+Z*Q3+6.*Q4+YU*Q5+YU*Q6+YU*Q7
      Q1=B3*R(79)
      Q2=B8*R(170)+B9*R(169)
      Q3=B3*R(251)
      Q4=B3*R(344)+B16*R(343)
      Q5=-42.*B16
      Q6=B23*R(422)+B24*R(421)
      Q7=B3*R(514)
      G(175)=Q1+6.*Q2+Z*Q3+6.*Q4+YU*Q5+YU*Q6+YU*Q7
      Q1=B3*R(80)
      Q2=B8*R(171)+B9*R(170)
      Q3=B3*R(252)
      Q4=B3*R(345)+B16*R(344)+B17*R(343)
      Q5=-42.*B17
      Q6=B24*R(422)
```

```
      Q7=B3*R(515)
      G(176)=Q1+6.*Q2+Z*Q3+6.*Q4+YU*Q5+YU*Q6+YU*Q7
      Q1=B3*R(81)
      Q2=B8*R(172)+B9*R(171)
      Q3=B16*R(345)+B17*R(344)
      G(177)=Q1+6.*Q2+6.*Q3
      Q1=B3*R(82)
      Q2=B9*R(172)
      Q3=B17*R(345)
      G(178)=Q1+6.*Q2+6.*Q3
      RETURN
      END
$ORIGIN        A
$IBFTC SUBB
      SUBROUTINE SUB2(P,THETA,ANU,AK,G)
      DOUBLE PRECISION BIGM(4,4),V(4),P2,S2,C2,C4,THA,A10,AY,AN,ANN,BY,
     1BE,BEE,CY,DY,DN,DNN,DE,DEE,DNE,WNN,WEE,WNE,DEFL,AMX,AMY,AMXY,
     2AMMAX,AMMIN,G(178)
      THA=THETA*3.14159265358979/180.
      S=DSIN(THA)
      C=DCOS(THA)
      S2=S*S
      C2=C*C
      C4=C2*C2
      P2=P*P
      A10=-2.*S*P
      BIGM(1,1)=G(1)/25.+G(2)/175.-G(3)/1225.+G(4)/175.+G(5)/525.-
     1G(6)/3675.+G(7)/1225.-G(8)/3675.+G(9)/525.+G(10)/1155.-G(11)/8085.
     1+G(12)/3675.-G(13)/11025.+G(14)/3675.-G(15)/8085.+G(16)/1155.-
     1G(17)/15015.+G(18)/8085.-G(19)/24255.+G(20)/11025.-G(21)/24255.+
     1G(22)/8085.-G(23)/15015.+G(24)/15015.-G(25)/45045.+G(26)/24255.-
     1G(27)/53361.+G(28)/24255.-G(29)/45045.+G(30)/15015.+G(31)/45045.-
     1G(32)/99099.+G(33)/53361.-G(34)/99099.+G(35)/45045.
      BIGM(2,1)=G(1)/175.+G(2)/1225.-G(3)/3675.+G(4)/525.+G(5)/3675.-
     1G(6)/11025.+G(7)/3675.-G(8)/8085.+G(9)/1155.+G(10)/8085.-
     1G(11)/24255.+G(12)/11025.-G(13)/24255.+G(14)/8085.-G(15)/15015.+
     1G(16)/2145.-G(17)/45045.+G(18)/24255.-G(19)/53361.+G(20)/24255.-
     1G(21)/45045.+G(22)/15015.-G(23)/25025.+G(24)/45045.-G(25)/99099.+
     1G(26)/53361.-G(27)/99099.+G(28)/45045.-G(29)/75075.+G(30)/25025.+
     1G(31)/99099.-G(32)/184041.+G(33)/99099.-G(34)/165165.+G(35)/75075.
      BIGM(3,1)=G(1)/175.+G(2)/525.-G(3)/3675.+G(4)/1225.+G(5)/1155.-
     1G(6)/8085.+G(7)/3675.-G(8)/11025.+G(9)/3675.+G(10)/2145.-
     1G(11)/15015.+G(12)/8085.-G(13)/24255.+G(14)/11025.-G(15)/24255.+
     1G(16)/8085.-G(17)/25025.+G(18)/15015.-G(19)/45045.+G(20)/24255.-
     1G(21)/53361.+G(22)/24255.-G(23)/45045.+G(24)/25025.-G(25)/75075.+
     1G(26)/45045.-G(27)/99099.+G(28)/53361.-G(29)/99099.+G(30)/45045.+
     1G(31)/75075.-G(32)/165165.+G(33)/99099.-G(34)/184041.+G(35)/99099.
      BIGM(4,1)=G(1)/1225.+G(2)/3675.-G(3)/11025.+G(4)/3675.+G(5)/8085.-
     1G(6)/24255.+G(7)/11025.-G(8)/24255.+G(9)/8085.+G(10)/15015.-
     1G(11)/45045.+G(12)/24255.-G(13)/53361.+G(14)/24255.-G(15)/45045.+
     1G(16)/15015.-G(17)/75075.+G(18)/45045.-G(19)/99099.+G(20)/53361.-
     1G(21)/99099.+G(22)/45045.-G(23)/75075.+G(24)/75075.-G(25)/165165.+
     1G(26)/99099.-G(27)/184041.+G(28)/99099.-G(29)/165165.+G(30)/75075.
     1+G(31)/165165.-G(32)/306735.+G(33)/184041.-G(34)/306735.
     1+G(35)/165165.
```

```
      BIGM(1,2)=G(36)/25.+G(37)/175.-G(38)/1225.+G(39)/175.+G(40)/525.-
     1G(41)/3675.+G(42)/1225.-G(43)/3675.+G(44)/525.+G(45)/1155.-
     1G(46)/8085.+G(47)/3675.-G(48)/11025.+G(49)/3675.-G(50)/8085.+
     1G(51)/11525.-G(52)/15015.+G(53)/8085.-G(54)/24255.+G(55)/11025.-
     1G(56)/24255.+G(57)/8085.-G(58)/15015.+G(59)/2145.+G(60)/15015.-
     1G(61)/45045.+G(62)/24255.-G(63)/53361.+G(64)/24255.-G(65)/45045.+
     1G(66)/15015.-G(67)/25025.+G(68)/45045.-G(69)/99099.+G(70)/53361.-
     1G(71)/99099.+G(72)/45045.-G(73)/75075.+G(74)/25025.+G(75)/99099.-
     1G(76)/184041.+G(77)/99099.-G(78)/165165.+G(79)/75075.
      BIGM(2,2)=G(36)/175.+G(37)/1225.-G(38)/3675.+G(39)/525.+
     1G(40)/3675.-G(41)/11025.+G(42)/3675.-G(43)/8085.+G(44)/1155.+
     1G(45)/8085.-G(46)/24255.+G(47)/11025.-G(48)/24255.+G(49)/8085.-
     1G(50)/15015.+G(51)/2145.-G(52)/45045.+G(53)/24255.-G(54)/53361.+
     1G(55)/24255.-G(56)/45045.+G(57)/15015.-G(58)/25025.+G(59)/3575.+
     1G(60)/45045.-G(61)/99099.+G(62)/53361.-G(63)/99099.+G(64)/45045.-
     1G(65)/75075.+G(66)/25025.-G(67)/38675.+G(68)/99099.-G(69)/184041.+
     1G(70)/99099.-G(71)/165165.+G(72)/75075.-G(73)/116025.+G(74)/38675.
     1+G(75)/184041.-G(76)/306735.+G(77)/165165.-G(78)/255255.+
     1G(79)/116025.
      BIGM(3,2)=G(36)/175.+G(37)/525.-G(38)/3675.+G(39)/1225.+
     1G(40)/1155.-G(41)/8085.+G(42)/3675.-G(43)/11025.+G(44)/3675.+
     1G(45)/2145.-G(46)/15015.+G(47)/8085.-G(48)/24255.+G(49)/11025.-
     1G(50)/24255.+G(51)/8085.-G(52)/25025.+G(53)/15015.-G(54)/45045.+
     1G(55)/24255.-G(56)/53361.+G(57)/24255.-G(58)/45045.+G(59)/15015.+
     1G(60)/25025.-G(61)/75075.+G(62)/45045.-G(63)/99099.+G(64)/53361.-
     1G(65)/99099.+G(66)/45045.-G(67)/75075.+G(68)/75075.-G(69)/165165.+
     1G(70)/99099.-G(71)/184041.+G(72)/99099.-G(73)/165165.+G(74)/75075.
     1+G(75)/165165.-G(76)/306735.+G(77)/184041.-G(78)/306735.+
     1G(79)/165165.
      BIGM(4,2)=G(36)/1225.+G(37)/3675.-G(38)/11025.+G(39)/3675.+
     1G(40)/8085.-G(41)/24255.+G(42)/11025.-G(43)/24255.+G(44)/8085.+
     1G(45)/15015.-G(46)/45045.+G(47)/24255.-G(48)/53361.+G(49)/24255.-
     1G(50)/45045.+G(51)/15015.-G(52)/75075.+G(53)/45045.-G(54)/99099.+
     1G(55)/53361.-G(56)/99099.+G(57)/45045.-G(58)/75075.+G(59)/25025.+
     1G(60)/75075.-G(61)/165165.+G(62)/99099.-G(63)/184041.+G(64)/99099.
     1-G(65)/165165.+G(66)/75075.-G(67)/116025.+G(68)/165165.-
     1G(69)/306735.+G(70)/184041.-G(71)/306735.+G(72)/165165.-
     1G(73)/255255.+G(74)/116025.+G(75)/306735.-G(76)/511225.+
     1G(77)/306735.-G(78)/474045.+G(79)/255255.
      BIGM(1,3)=G(80)/25.+G(81)/175.-G(82)/1225.+G(83)/175.+G(84)/525.-
     1G(85)/3675.+G(86)/1225.-G(87)/3675.+G(88)/525.+G(89)/1155.-
     1G(90)/8085.+G(91)/3675.-G(92)/11025.+G(93)/3675.-G(94)/8085.+
     1G(95)/11525.+G(96)/2145.-G(97)/15015.+G(98)/8085.-G(99)/24255.+
     1G(100)/11025.-G(101)/24255.+G(102)/8085.-G(103)/15015.-
     1G(104)/25025.+G(105)/15015.-G(106)/45045.+G(107)/24255.-
     1G(108)/53361.+G(109)/24255.-G(110)/45045.+G(111)/15015.+
     1G(112)/25025.-G(113)/75075.+G(114)/45045.-G(115)/99099.+
     1G(116)/53361.-G(117)/99099.+G(118)/45045.+G(119)/75075.-
     1G(120)/165165.+G(121)/99099.-G(122)/184041.+G(123)/99099.
      BIGM(2,3)=G(80)/175.+G(81)/1225.-G(82)/3675.+G(83)/525.+
     1G(84)/3675.-G(85)/11025.+G(86)/3675.-G(87)/8085.+G(88)/1155.+
     1G(89)/8085.-G(90)/24255.+G(91)/11025.-G(92)/24255.+G(93)/8085.-
     1G(94)/15015.+G(95)/2145.+G(96)/15015.-G(97)/45045.+G(98)/24255.-
     1G(99)/53361.+G(100)/24255.-G(101)/45045.+G(102)/15015.-
     1G(103)/25025.-G(104)/75075.+G(105)/45045.-G(106)/99099.+
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1G(107)/53361.-G(108)/99099.+G(109)/45045.-G(110)/75075.+
1G(111)/25025.+G(112)/75075.-G(113)/165165.+G(114)/99099.-
1G(115)/184041.+G(116)/99099.-G(117)/165165.+G(118)/75075.+
1G(119)/165165.-G(120)/306735.+G(121)/184041.-G(122)/306735.+
1G(123)/165165.
 BIGM(3,3)=G(80)/175.+G(81)/525.-G(82)/3675.+G(83)/1225.+
1G(84)/1155.-G(85)/8085.+G(86)/3675.-G(87)/11025.+G(88)/3675.+
1G(89)/2145.-G(90)/15015.+G(91)/8085.-G(92)/24255.+G(93)/11025.-
1G(94)/24255.++(95)/8085.+G(96)/3575.-G(97)/25025.+G(98)/15015.-
1G(99)/45045.+G(100)/24255.-G(101)/53361.+G(102)/24255.-
1G(103)/45045.-G(104)/38675.+G(105)/25025.-G(106)/75075.+
1G(107)/45045.-G(108)/99099.+G(109)/53361.-G(110)/99099.+
1G(111)/45045.+G(112)/38675.-G(113)/116025.+G(114)/75075.-
1G(115)/165165.+G(116)/99099.-G(117)/184041.+G(118)/99099.+
1G(119)/116025.-G(120)/255255.+G(121)/165165.-G(122)/306735.+
1G(123)/184041.
 BIGM(4,3)=G(80)/1225.+G(81)/3675.-G(82)/11025.+G(83)/3675.+
1G(84)/8085.-G(85)/24255.+G(86)/11025.-G(87)/24255.+G(88)/8085.+
1G(89)/15015.-G(90)/45045.+G(91)/24255.-G(92)/53361.+G(93)/24255.-
1G(94)/45045.+G(95)/15015.+G(96)/25025.-G(97)/75075.+G(98)/45045.-
1G(99)/99099.+G(100)/53361.-G(101)/99099.+G(102)/45045.-
1G(103)/75075.-G(104)/116025.+G(105)/75075.-G(106)/165165.+
1G(107)/99099.-G(108)/184041.+G(109)/99099.-G(110)/165165.+
1G(111)/75075.+G(112)/116025.-G(113)/255255.+G(114)/165165.-
1G(115)/306735.+G(116)/184041.-G(117)/306735.+G(118)/165165.+
1G(119)/255255.-G(120)/474045.+G(121)/306735.-G(122)/511225.+
1G(123)/306735.
 BIGM(1,4)=G(124)/25.+G(125)/175.-G(126)/1225.+G(127)/175.+
1G(128)/525.-G(129)/3675.+G(130)/1225.-G(131)/3675.+G(132)/525.+
1G(133)/1155.-G(134)/8085.+G(135)/3675.-G(136)/11025.+G(137)/3675.-
1G(138)/8085.+G(139)/1155.+G(140)/2145.-G(141)/15015.+G(142)/8085.-
1G(143)/24255.+G(144)/11025.-G(145)/24255.+G(146)/8085.-
1G(147)/15015.+G(148)/2145.-G(149)/25025.+G(150)/15015.-
1G(151)/45045.+G(152)/24255.-G(153)/53361.+G(154)/24255.-
1G(155)/45045.+G(156)/15015.-G(157)/25025.+G(158)/25025.-
1G(159)/75075.+G(160)/45045.-G(161)/99099.+G(162)/53361.-
1G(163)/99099.+G(164)/45045.-G(165)/75075.+G(166)/25025.+
1G(167)/75075.-G(168)/165165.+G(169)/99099.-G(170)/184041.+
1G(171)/99099.-G(172)/165165.+G(173)/75075.+G(174)/165165.-
1G(175)/306735.+G(176)/184041.-G(177)/306735.+G(178)/165165.
 BIGM(2,4)=G(124)/175.+G(125)/1225.-G(126)/3675.+G(127)/525.+
1G(128)/3675.-G(129)/11025.+G(130)/3675.-G(131)/8085.+G(132)/1155.+
1G(133)/8085.-G(134)/24255.+G(135)/11025.-G(136)/24255.+
1G(137)/8085.-G(138)/15015.+G(139)/2145.+G(140)/15015.-
1G(141)/45045.+G(142)/24255.-G(143)/53361.+G(144)/24255.-
1G(145)/45045.+G(146)/15015.-G(147)/25025.+G(148)/3575.-
1G(149)/75075.+G(150)/45045.-G(151)/99099.+G(152)/53361.-
1G(153)/99099.+G(154)/45045.-G(155)/75075.+G(156)/25025.-
1G(157)/38675.+G(158)/75075.-G(159)/165165.+G(160)/99099.-
1G(161)/184041.+G(162)/99099.-G(163)/165165.+G(164)/75075.-
1G(165)/116025.+G(166)/38675.+G(167)/165165.-G(168)/306735.+
1G(169)/184041.-G(170)/306735.+G(171)/165165.-G(172)/255255.+
1G(173)/116025.+G(174)/306735.-G(175)/511225.+G(176)/306735.-
1G(177)/474045.+G(178)/255255.
 BIGM(3,4)=G(124)/175.+G(125)/525.-G(126)/3675.+G(127)/1225.+
```

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     1G(128)/1155.-G(129)/8085.+G(130)/3675.-G(131)/11025.+G(132)/3675.+
     1G(133)/2145.-G(134)/15015.+G(135)/8085.-G(136)/24255.+
     1G(137)/11025.-G(138)/24255.+G(139)/8085.+G(140)/3575.-
     1G(141)/25025.+G(142)/15015.-G(143)/45045.+G(144)/24255.-
     1G(145)/53361.+G(146)/24255.-G(147)/45045.+G(148)/15015.-
     1G(149)/38675.+G(150)/25025.-G(151)/75075.+G(152)/45045.-
     1G(153)/99099.+G(154)/53361.-G(155)/99099.+G(156)/45045.-
     1G(157)/75075.+G(158)/38675.-G(159)/116025.+G(160)/75075.-
     1G(161)/165165.+G(162)/99099.-G(163)/184041.+G(164)/99099.-
     1G(165)/165165.+G(166)/75075.+G(167)/116025.-G(168)/255255.+
     1G(169)/165165.-G(170)/306735.+G(171)/184041.-G(172)/306735.+
     1G(173)/165165.+G(174)/255255.-G(175)/474045.+G(176)/306735.-
     1G(177)/511225.+G(178)/306735.
      BIGM(4,4)=G(124)/1225.+G(125)/3675.-G(126)/11025.+G(127)/3675.+
     1G(128)/8085.-G(129)/24255.+G(130)/11025.-G(131)/24255.+
     1G(132)/8085.+G(133)/15015.-G(134)/45045.+G(135)/24255.-
     1G(136)/53361.+G(137)/24255.-G(138)/45045.+G(139)/15015.+
     1G(140)/25025.-G(141)/75075.+G(142)/45045.-G(143)/99099.+
     1G(144)/53361.-G(145)/99099.+G(146)/45045.-G(147)/75075.+
     1G(148)/25025.-G(149)/116025.+G(150)/75075.-G(151)/165165.+
     1G(152)/99099.-G(153)/184041.+G(154)/99099.-G(155)/165165.+
     1G(156)/75075.-G(157)/116025.+G(158)/116025.-G(159)/255255.+
     1G(160)/165165.-G(161)/306735.+G(162)/184041.-G(163)/306735.+
     1G(164)/165165.-G(165)/255255.+G(166)/116025.+G(167)/255255.-
     1G(168)/474045.+G(169)/306735.-G(170)/511225.+G(171)/306735.-
     1G(172)/474045.+G(173)/255255.+G(174)/474045.-G(175)/790075.+
     1G(176)/511225.-G(177)/790075.+G(178)/474045.
      V(1)=C4/25.
      V(2)=C4/175.
      V(3)=V(2)
      V(4)=C4/1225.
      CALL DLEQU(0,BIGM,4,4,V,1,LUCK)
      WRITE (6,250) P,THETA,ANU,AK,(V(L),L=1,4),LUCK
  250 FORMAT (4F8.3,4E16.8,I5)
      DIMENSION TETA(17),TAXI(2)
      READ (5,300) (TETA(I),I=1,17),(TAXI(J),J=1,2)
  300 FORMAT (19F4.1)
      DO 71 J=1,2
      AXI=TAXI(J)
      DO 71 I=1,17
      ETA=TETA(I)
      AY=(1.-ETA**2)**2
      AN=(ETA**3-ETA)*4.
      ANN=(3.*ETA**2-1.)*4.
      BY=(1.-AXI**2)**2
      BE=(AXI**3-AXI)*4.
      BEE=(3.*AXI**2-1.)*4.
      CY=(1.-ETA*AXI)
      DY=V(1)+V(2)*ETA**2+V(3)*AXI**2+V(4)*ETA**2*AXI**2
      DN=(V(2)*ETA+V(4)*ETA*AXI**2)*2.
      DNN=(V(2)+V(4)*AXI**2)*2.
      DE=(V(3)*AXI+V(4)*ETA**2*AXI)*2.
      DEE=(V(3)+V(4)*ETA**2)*2.
      DNE=4.*ETA*AXI*V(4)
      DEFL=AY*BY*CY*DY
```

```
      WNN=BY*(ANN*CY*DY-AXI*AN*DY+AN*CY*DN-AXI*AN*DY-AXI*AY*DN+AN*CY*DN
     1-AXI*AY*DN+AY*CY*DNN)
      WEE=AY*(BEE*CY*DY-BE*ETA*DY+BE*CY*DE-BE*ETA*DY-BY*ETA*DE+BE*CY*DE
     1-BY*ETA*DE+BY*CY*DEE)
      WNE=AN*BE*CY*DY-AN*BY*ETA*DY+AN*BY*CY*DE-AY*BE*AXI*DY-AY*BY*DY
     1-AY*BY*AXI*DE+AY*BE*CY*DN-AY*BY*ETA*DN+AY*BY*CY*DNE
      AMX=(AK*ETA*AXI-1.)**3*(P2*WEE+A10*WNE+(S2+ANU*C2)*WNN)/C2
      AMY=(AK*ETA*AXI-1.)**3*(ANU*P2*WEE+ANU*A10*WNE+(ANU*S2+C2)*WNN)/C2
      AMXY=(ANU-1.)*(AK*ETA*AXI-1.)**3*(P*WNE-S*WNN)/C
      AMMAX=(AMX+AMY)/2.+SQRT(((AMX-AMY)/2.)**2+AMXY**2)
      AMMIN=(AMX+AMY)/2.-SQRT(((AMX-AMY)/2.)**2+AMXY**2)
      SMAX=6.*AMMAX/(1.-AK*ETA*AXI)**2
      SMIN=6.*AMMIN/(1.-AK*ETA*AXI)**2
      IF (AMX-AMY) 411,407,411
  407 IF (AMXY) 408,409,410
  408 ALPHA=-45.00
      GO TO 71
  409 ALPHA=0.0
      GO TO 71
  410 ALPHA=45.00
      GO TO 71
  411 PIPE=2.*AMXY/(AMX-AMY)
      ALPHA=28.64789*ATAN(PIPE)
   71 WRITE (6,150) AXI,ETA,SMAX,SMIN,AMMAX,AMMIN,DEFL,ALPHA
  150 FORMAT (2F8.3,6E16.8)
      RETURN
      END
```

(b) Fortran Programme for Experimental Analysis

(For IBM 1620 II Computer)

```
C       EXPERIMENTAL STUDIES ON CLAMPED SKEWED PLATES
C       WITH VARIABLE THICKNESS
    5 N=0
      SMAX=0.0
      SMIN=0.0
    2 READ 3,T,EA,EB,EC
    3 FORMAT (4F10.6)
      N=N+1
      E=470000.
      ANU=0.300
      A1=(EA+EC)/(1.-ANU)
      A2=(1./(1.+ANU))*SQRTF(2.*(EA-EB)**2+2.*(EB-EC)**2)
      SMAX=SMAX+(E/2.)*(A1+A2)
      SMIN=SMIN+(E/2.)*(A1-A2)
      IF (N-6)6,7,7
    6 CONTINUE
      GO TO 2
    7 B1=SMAX/6.0
      B2=SMIN/6.0
      A3=T*T/6.0
      AMMAX=B1*A3
      AMMIN=B2*A3
      PUNCH 4,T,B1,B2,AMMAX,AMMIN
    4 FORMAT (F6.3,4F12.5)
      GO TO 5
      END
```

APPENDIX B

EXPERIMENTAL DATA

TABLE VI

Experimental Data for Lateral Deflections

(1/1000 in.)

Dial Gauge	p.s.i.	Loading			Unloading			Average
		Test 1	Test 2	Test 3	Test 1	Test 2	Test 3	
D	0.1757	4.50	5.00	5.00	6.00	6.00	6.50	5.50
	0.5325	14.0	14.8	14.0	17.5	16.5	17.2	15.7
	0.7934	21.5	22.0	20.1	25.5	24.0	24.4	22.9
	1.0331	29.0	29.0	27.7	32.5	31.0	31.0	30.0
	1.2514	35.0	35.0	35.5	38.6	37.0	37.0	36.4
	1.5017	42.0	41.8	40.0	45.8	44.0	43.7	42.9
	1.7360	48.7	48.6	47.0	52.0	50.0	49.5	49.3
	1.9703	55.0	54.5	53.3	58.0	56.8	55.3	55.5
	2.2259	62.0	59.5	60.0	63.2	61.0	61.6	61.2
	2.3600	69.0	65.0	64.1	70.0	66.0	65.0	66.5
E	0.1757	2.00	2.00	2.00	3.00	2.40	3.10	2.42
	0.5325	5.60	5.50	5.60	7.00	6.50	7.00	6.20
	0.7934	8.50	8.80	8.40	10.0	9.50	9.00	9.03
	1.0331	11.3	11.0	11.0	12.8	12.0	12.5	11.8
	1.2514	13.5	13.5	13.2	15.2	14.5	14.8	14.1
	1.5017	16.4	15.8	16.0	18.0	17.2	17.5	16.8
	1.7360	19.0	19.0	18.5	20.5	19.8	20.0	19.5
	1.9703	22.0	21.5	21.1	23.0	22.2	22.0	22.0
	2.2259	24.5	23.5	24.0	25.0	24.0	24.4	24.2
	2.3600	27.3	25.7	25.5	27.8	26.0	25.9	26.4
F	0.1757	2.20	2.00	2.10	3.50	3.00	4.80	2.93
	0.5325	7.00	7.00	7.00	9.80	8.10	8.80	7.95
	0.7934	10.8	10.8	10.0	13.0	12.0	12.0	11.4
	1.0331	14.5	14.0	13.5	16.8	15.5	15.2	14.9
	1.2514	17.5	17.2	16.5	20.0	18.5	18.3	18.0
	1.5017	21.0	20.8	20.0	23.0	22.0	22.0	21.5
	1.7360	24.5	24.0	23.3	26.4	25.0	25.0	24.7
	1.9703	28.0	27.0	27.0	29.8	28.5	28.0	28.1
	2.2259	31.5	29.8	30.0	32.3	30.8	31.0	30.9
	2.3600	35.0	32.6	32.1	35.6	33.3	32.8	33.6

TABLE VII

Experimental Data for Unit Strains from Rosette Gauges

(Test 1)

Gauge	p.s.i.	Loading			Unloading		
		E_a	E_b	E_c	E_a	E_b	E_c
A	0.1757	0.000069	0.000107	0.000046	0.000079	0.000100	0.000057
	0.5325	0.000196	0.000310	0.000124	0.000232	0.000323	0.000134
	0.7934	0.000283	0.000446	0.000174	0.000323	0.000475	0.000185
	1.0331	0.000376	0.000615	0.000222	0.000406	0.000618	0.000233
	1.2514	0.000455	0.000733	0.000265	0.000488	0.000729	0.000274
	1.5017	0.000538	0.000854	0.000308	0.000576	0.000875	0.000320
	1.7360	0.000646	0.000996	0.000364	0.000646	0.000990	0.000356
	1.9703	0.000718	0.001122	0.000402	0.000732	0.001136	0.000400
	2.2259	0.000812	0.001260	0.000448	0.000804	0.001236	0.000438
	2.3600	0.000912	0.001420	0.000492	0.000900	0.001388	0.000484
B	0.1757	0.000065	0.000100	0.000067	0.000040	0.000072	0.000054
	0.5325	0.000174	0.000324	0.000167	0.000153	0.000297	0.000157
	0.7934	0.000249	0.000462	0.000230	0.000238	0.000460	0.000230
	1.0331	0.000323	0.000621	0.000300	0.000308	0.000596	0.000300
	1.2514	0.000382	0.000750	0.000362	0.000370	0.000730	0.000358
	1.5017	0.000452	0.000880	0.000440	0.000438	0.000876	0.000424
	1.7360	0.000523	0.001016	0.000504	0.000498	0.000992	0.000472
	1.9703	0.000576	0.001132	0.000564	0.000562	0.001122	0.000520
	2.2259	0.000644	0.001272	0.000636	0.000622	0.001248	0.000594
	2.3600	0.000712	0.001420	0.000652	0.000692	0.001396	0.000666
C	0.1757	0.000034	0.000018	0.000011	0.000066	0.000036	0.000021
	0.5325	0.000096	0.000068	0.000013	0.000132	0.000084	0.000021
	0.7934	0.000132	0.000107	0.000013	0.000176	0.000121	0.000021
	1.0331	0.000175	0.000148	0.000014	0.000216	0.000154	0.000019
	1.2514	0.000213	0.000160	0.000008	0.000252	0.000180	0.000015
	1.5017	0.000242	0.000184	0.000000	0.000286	0.000211	0.000011
	1.7360	0.000294	0.000224	0.000009	0.000308	0.000226	0.000000
	1.9703	0.000324	0.000244	0.000000	0.000348	0.000254	0.000000
	2.2259	0.000368	0.000282	0.000000	0.000378	0.000284	0.000003
	2.3600	0.000412	0.000318	-0.000004	0.000414	0.000316	0.000000
D	0.1757	0.000070	0.000083	0.000033	0.000092	0.000098	0.000047
	0.5325	0.000184	0.000258	0.000110	0.000224	0.000280	0.000114
	0.7934	0.000274	0.000370	0.000139	0.000323	0.000395	0.000152
	1.0331	0.000364	0.000476	0.000189	0.000434	0.000516	0.000193
	1.2514	0.000434	0.000570	0.000238	0.000472	0.000620	0.000226
	1.5017	0.000512	0.000700	0.000252	0.000562	0.000714	0.000274
	1.7360	0.000604	0.000832	0.000296	0.000628	0.000800	0.000306
	1.9703	0.000672	0.000878	0.000348	0.000710	0.000908	0.000330
	2.2259	0.000756	0.000994	0.000388	0.000774	0.001008	0.000378
	2.3600	0.000852	0.001116	0.000408	0.000856	0.001112	0.000416

TABLE VII (Cont'd.)

Experimental Data for Unit Strains from Rosette Gauges

(Test 2)

Gauge	p.s.i.	Loading			Unloading		
		E_a	E_b	E_c	E_a	E_b	E_c
A	0.1757	0.000080	0.000099	0.000048	0.000101	0.000096	0.000078
	0.5325	0.000211	0.000304	0.000124	0.000225	0.000293	0.000152
	0.7934	0.000306	0.000445	0.000175	0.000312	0.000451	0.000196
	1.0331	0.000402	0.000570	0.000222	0.000388	0.000583	0.000236
	1.2514	0.000467	0.000694	0.000266	0.000464	0.000706	0.000282
	1.5017	0.000559	0.000830	0.000311	0.000562	0.000850	0.000329
	1.7360	0.000612	0.000956	0.000352	0.000628	0.000954	0.000366
	1.9703	0.000700	0.001076	0.000396	0.000712	0.001092	0.000406
	2.2259	0.000760	0.001172	0.000428	0.000778	0.001186	0.000438
	2.3600	0.000838	0.001300	0.000472	0.000840	0.001300	0.000476
B	0.1757	0.000057	0.000104	0.000059	0.000076	0.000107	0.000104
	0.5325	0.000170	0.000322	0.000166	0.000178	0.000316	0.000197
	0.7934	0.000253	0.000473	0.000231	0.000259	0.000476	0.000261
	1.0331	0.000321	0.000612	0.000294	0.000328	0.000615	0.000324
	1.2514	0.000376	0.000718	0.000356	0.000390	0.000742	0.000384
	1.5017	0.000456	0.000877	0.000421	0.000464	0.000892	0.000452
	1.7360	0.000518	0.000996	0.000476	0.000520	0.001008	0.000510
	1.9703	0.000580	0.001140	0.000548	0.000586	0.001144	0.000580
	2.2259	0.000628	0.001230	0.000606	0.000632	0.001240	0.000624
	2.3600	0.000686	0.001340	0.000666	0.000684	0.001352	0.000676
C	0.1757	0.000041	0.000029	0.000011	0.000078	0.000037	0.000028
	0.5325	0.000100	0.000072	0.000012	0.000134	0.000090	0.000023
	0.7934	0.000141	0.000107	0.000011	0.000180	0.000119	0.000021
	1.0331	0.000182	0.000136	0.000011	0.000212	0.000150	0.000018
	1.2514	0.000218	0.000170	0.000014	0.000249	0.000185	0.000020
	1.5017	0.000261	0.000198	0.000012	0.000289	0.000209	0.000016
	1.7360	0.000288	0.000220	0.000000	0.000310	0.000228	0.000008
	1.9703	0.000330	0.000248	0.000000	0.000348	0.000256	0.000004
	2.2259	0.000356	0.000276	0.000002	0.000370	0.000282	-0.000002
	2.3600	0.000396	0.000302	0.000000	0.000398	0.000308	-0.000002
D	0.1757	0.000055	0.000068	0.000028	0.000091	0.000088	0.000042
	0.5325	0.000176	0.000230	0.000093	0.000214	0.000256	0.000106
	0.7934	0.000265	0.000359	0.000131	0.000304	0.000371	0.000144
	1.0331	0.000344	0.000450	0.000168	0.000380	0.000484	0.000184
	1.2514	0.000423	0.000555	0.000217	0.000455	0.000580	0.000221
	1.5017	0.000500	0.000669	0.000249	0.000546	0.000692	0.000257
	1.7360	0.000576	0.000762	0.000290	0.000606	0.000772	0.000288
	1.9703	0.000656	0.000852	0.000312	0.000684	0.000890	0.000336
	2.2259	0.000712	0.000946	0.000352	0.000742	0.000948	0.000362
	2.3600	0.000788	0.001046	0.000392	0.000806	0.001036	0.000396

TABLE VII (Cont'd.)

Experimental Data for Unit Strains from Rosette Gauges
(Test 3)

Gauge	p.s.i.	Loading			Unloading		
		E_a	E_b	E_c	E_a	E_b	E_c
A	0.1757	0.000180	0.000101	0.000043	0.000067	0.000107	0.000074
	0.5325	0.000168	0.000290	0.000116	0.000206	0.000307	0.000138
	0.7934	0.000298	0.000434	0.000160	0.000272	0.000443	0.000183
	1.0331	0.000321	0.000556	0.000206	0.000372	0.000576	0.000224
	1.2514	0.000427	0.000688	0.000250	0.000430	0.000696	0.000268
	1.5017	0.000517	0.000823	0.000298	0.000565	0.000833	0.000314
	1.7360	0.000580	0.000932	0.000340	0.000616	0.000940	0.000344
	1.9703	0.000652	0.001052	0.000378	0.000704	0.001058	0.000384
	2.2259	0.000740	0.001190	0.000428	0.000748	0.001190	0.000428
	2.3600	0.000812	0.001272	0.000454	0.000812	0.001270	0.000458
B	0.1757	0.000058	0.000096	0.000074	0.000080	0.000120	0.000082
	0.5325	0.000162	0.000300	0.000148	0.000184	0.000334	0.000174
	0.7934	0.000239	0.000456	0.000226	0.000261	0.000482	0.000244
	1.0331	0.000310	0.000584	0.000285	0.000329	0.000657	0.000324
	1.2514	0.000384	0.000736	0.000354	0.000390	0.000744	0.000374
	1.5017	0.000446	0.000855	0.000386	0.000461	0.000884	0.000437
	1.7360	0.000508	0.000976	0.000452	0.000516	0.000996	0.000486
	1.9703	0.000568	0.001112	0.000522	0.000572	0.001120	0.000546
	2.2259	0.000640	0.001252	0.000596	0.000640	0.001258	0.000612
	2.3600	0.000680	0.001332	0.000644	0.000676	0.001334	0.000644
C	0.1757	0.000035	0.000032	-0.000002	0.000070	0.000031	0.000007
	0.5325	0.000090	0.000064	0.000000	0.000130	0.000072	0.000002
	0.7934	0.000130	0.000098	0.000004	0.000170	0.000109	0.000002
	1.0331	0.000173	0.000124	-0.000002	0.000204	0.000132	-0.000001
	1.2514	0.000209	0.000156	0.000000	0.000230	0.000164	0.000001
	1.5017	0.000245	0.000182	-0.000008	0.000284	0.000194	-0.000002
	1.7360	0.000272	0.000202	-0.000012	0.000302	0.000208	-0.000014
	1.9703	0.000316	0.000230	-0.000014	0.000340	0.000236	-0.000012
	2.2259	0.000364	0.000268	-0.000010	0.000370	0.000266	-0.000016
	2.3600	0.000386	0.000284	-0.000016	0.000388	0.000280	-0.000014
D	0.1757	0.000056	0.000072	0.000028	0.000084	0.000086	0.000038
	0.5325	0.000172	0.000244	0.000075	0.000196	0.000242	0.000102
	0.7934	0.000254	0.000350	0.000120	0.000286	0.000369	0.000150
	1.0331	0.000326	0.000444	0.000168	0.000356	0.000465	0.000176
	1.2514	0.000395	0.000541	0.000194	0.000424	0.000559	0.000220
	1.5017	0.000474	0.000658	0.000226	0.000508	0.000660	0.000245
	1.7360	0.000552	0.000736	0.000260	0.000572	0.000744	0.000242
	1.9703	0.000628	0.000824	0.000292	0.000648	0.000842	0.000312
	2.2259	0.000700	0.000932	0.000334	0.000732	0.000936	0.000348
	2.3600	0.000752	0.000994	0.000378	0.000768	0.000994	0.000368

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NOMENCLATURE

C_o, C_1, C_2, C_3	undetermined parameters in the assumed deflection function
2a, 2b	sides of plate along U and V axes, respectively
C	= cosineθ
D_o	flexural rigidity of plate at the centre $= Eh_o^3/12(1-\nu^2)$
D	flexural rigidity of plate at any point $= Eh^3/12(1-\nu^2)$
E_a, E_b, E_c	recorded unit strains in the three legs of a rosette gauge
E	Young's modulus
f	allowable stress
h_o	thickness of plate at the centre
h	thickness of plate at any point
K	positive adjustable constant less than one
M_x, M_y	bending moments per unit length of sections of a plate perpendicular to X and Y axes, respectively
M_{xy}	twisting moment per unit length of a section of a plate perpendicular to X axis
M_{max}	maximum principal moment
M_{min}	minimum principal moment
P	aspect ratio = b/a
q	intensity of a continuously distributed load
Q_x, Q_y	shearing forces parallel to Z axis per unit length of a section of a plate perpendicular to X and Y axes, respectively
S	= sineθ
U, V	oblique co-ordinates

w	lateral deflection
ζ	outwardly drawn normal
η, ξ	dimensionless oblique co-ordinates equal to V/b and U/a, respectively
ν	Poisson's ratio
σ_x	normal component of stress parallel to the X axis
σ_y	normal component of stress parallel to the Y axis
σ_{max}	maximum principal stress
σ_{min}	minimum principal stress
τ_{xy}	component of extrem fibre shearing stress
θ	angle of skew
ϕ	angle measured clockwise from the X axis, giving the direction in which maximum principal moment occurs

VITA AUCTORIS

Soo-peng Teo was born in Brunei Town, State of Brunei, in February 6, 1939. He received his secondary-school education in Kuching, Sarawak, Malaysia, and his undergraduate education at the National Taiwan University, Taiwan, China, where he earned the degree of Bachelor of Science in Civil Engineering in 1964. He was a teacher at his home town, Labuan, Sabah, Malaysia, in 1965. In October, 1966, he enrolled at the University of Windsor where he served as a research assistant while pursuing the degree of Master of Applied Science in Civil Engineering (Structures).