STRESS ANALYSIS OF FLEXIBLE-INEXTENSIBLE ARCH WITH VARIABLE CROSS SECTION

By

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NOTATION AND TERMINOLOGY

L	Span Length
M_0, V_0	moment and shear which would occur under the load in a simply supported beam having the same span as the arch
M_a, M_b	fixed end moments
η	total vertical displacement (positive for downward direction)
η_h	vertical displacement due to H being a unit
η_w	vertical deflection due to external load
$I(x)$	moment of inertia of the cross section at x
I_0	moment of inertia at center position
ω	radial displacement taken positive toward the center
$\tau(x)$	function used to determine moment of inertia at x(i.e. $I(x) = \tau(x) I_0$)
H_R	assumed horizontal reaction
λ	a parameter $\lambda^2 = \frac{H_R L^2}{EI_0}$
H	true horizontal reaction $H = H(\eta)$
$q(x)$	load uniformly distributed on the arch
ξ	nondimensional parameter $= \frac{x}{L}$
Φ_w, Φ_h	nondimensional functions
D	operator $\frac{d}{d\xi} = D$
n	nondimensional parameter $n = \frac{f}{L}$
f	rise of the parabolic arch
h_0	thickness of the cross section at $\xi = \frac{1}{2}$
b	width of the cross section which is a constant

$\vec{\Phi}_h$	a set of discrete functions obtained by using the shooting method (due to arch action)
$\vec{\Phi}_w$	a set of Green's functions obtained by using the shooting method (due to the beam action)
M,V	influence lines of bending moments and vertical shearing force
TV,TH	influence line of transversal shearing force and thrust force

INTRODUCTION

Due to the improvement of construction techniques and materials, curved structures have become increasingly important.

Generally, there are two methods of stress analysis of an arch; one is the elastic theory[1] which neglects the change in the geometry of the arch axis under loads when formulating the equilibrium conditions.

The second method is the deflection theory[2], the equilibrium conditions are written for the geometry of the deformed arch axis. Since in this theory the coefficients of the equilibrium equations depend on the displacements, the governing equations are no longer linear and the principle of superposition is not applicable.

For an arch with a long span length, the influence on the stresses by the deflection of the arch axis is considerably significant. In other words, it can not be neglected completely. At the present time, a completely satisfactory method for the analysis of stresses in a long span arch does not exist.

Practically, engineers use a method[3] based on both elastic theory and deflection theory. As a first approximation, the generalized forces of the arch determined by the elastic theory are applied on the arch axis, and the resulting deflection curve of the arch axis is determined. (Certainly, if the arch axis is considered to be in this deformed position, it is not in equilibrium under the action of the computed forces.) Thus, a second approximation is made by computing the forces for the arch in the deformed position. By applying the forces, which are the difference of the forces between the first and second approximations, the corresponding deflection of the arch axis is found. Then the forces can be computed from the new deformed position. By

repeating this procedure the equilibrium position of an arch, at which the forces and deflections are consistent, can be determined. This technique is fairly straight forward but lengthy. Also it is valid only for fixed loading conditions. For the case of moving loads, it is difficult to find the critical loading conditions which provide the maximum stresses at the sections of interest. Therefore, the following method is introduced in order to overcome this difficulty.

From the following derivation, it is readily seen that the governing differential equation is nonlinear. A linearization technique is introduced to make this problem solvable. In turn, the principle of superposition is employed so that the resultant forces in an arch can be expressed as the combination of the forces due to a simple beam and an arch action (i.e., horizontal reaction). The influence lines of sectional forces for different flexibility parameters[4], $\frac{H_R L^2}{EI_0}$, are calculated by the shooting method. With these influence lines the stresses at a particular section of an arch can be determined. Thus, the actual critical stresses or design stresses of a given section can be obtained by an interpolation technique.

DERIVATION OF GOVERNING DIFFERENTIAL EQUATION

Consider a fixed ends arch as shown in Fig. 1

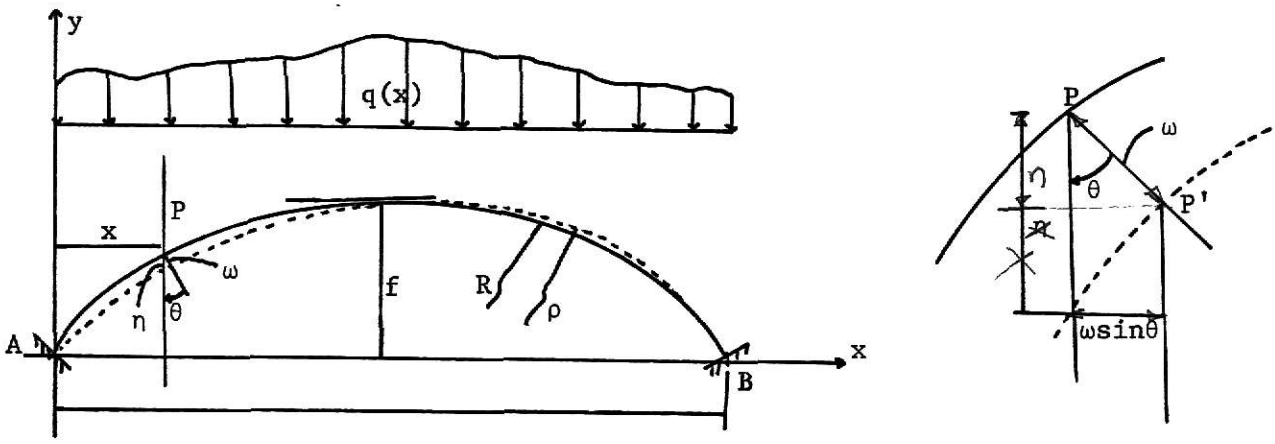

Fig. 1. Geometry of a fixed end arch

The following assumptions are introduced:

(1) Hookes' Law holds.

(2) The effects due to the horizontal component of deflection of a typical point of the arch axis is negligible.

(3) The change in slope at a point of the arch axis under loads is small and thus, the differential length of an arch may be expressed as $ds = \sec\theta dx$.

(4) The load is assumed to act directly on the arch-axis.

(5) The shearing deformation is neglected and the arch axis is inextensible.

(6) The radius of curvature is large in comparison with the radial displacement.

Based on the above assumptions, the bending moment M at a point x of the arch shown in Fig. 2 is:

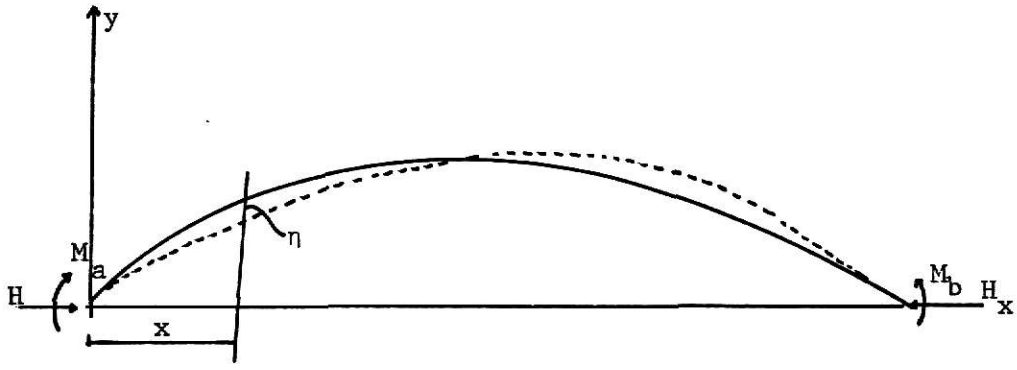

Figure 2

$$M = M_o - H(y - \eta) + M_a \left(1 - \frac{X}{L}\right) + M_b(X/L) \tag{1}$$

in which

$$M_o(x) = \int_o^x V_o(t)dt \tag{2}$$

$$V_o(x) = -\int_o^x q(t)dt + c \tag{3}$$

where M_0 and V_0 are bending moment and the shear force which would occur under the given load q(x) in a simple beam having the same span as the arch, H is the horizontal arch reaction, y is the curve function of arch axis, M_a and M_b are fixed end moments of the arch, ω is the radial displacement, and q(x) is the loading intensity.

Then consider an arch element slightly bent in its plane. Let R denote the initial radius of curvature of the center line of the arch. For a thin bar the relation between the change in curvature and the magnitude of the bending moment M can be expressed by the following equation,

$$EI\left(\frac{1}{\rho} - \frac{1}{R}\right) = -M \tag{a}$$

where E is the Young's modulus, I is the moment of inertia of the cross section of the bar, ρ is the raduis of curvature after deformation at any point

of the center line. The minus sign on the right-hand side of Eq. (a) follows from the sign convention of the bending moment which is taken to be positive when it produces a decrease in the initial curvature of the bar. The change in the curvature of the bar during bending can be found from a consideration of the deformation of a small element m n of the bar between two radii with the angle dθ as shown in Fig. 3.

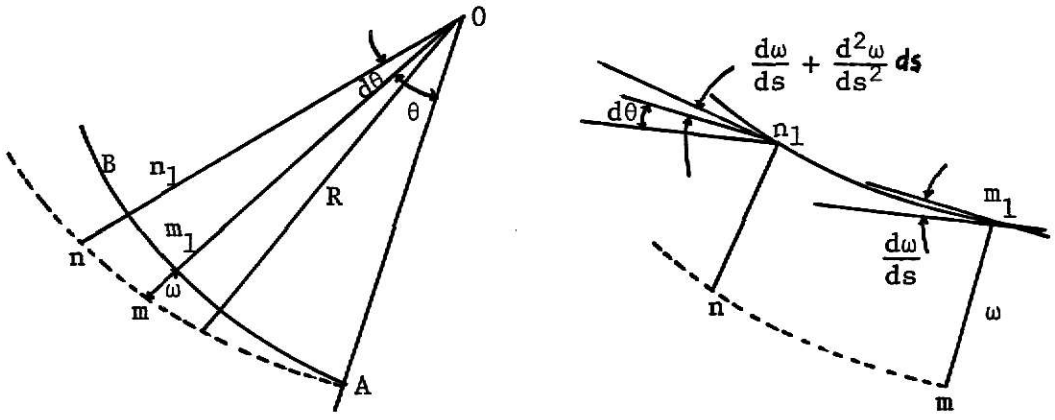

Figure 3

Then initial curvature length of the element and its initial curvature are

$$ds = Rd\theta$$

$$\frac{d\theta}{ds} = \frac{1}{R} \qquad (b)$$

The radial displacement of a point m during bending, assumed to be a small quantity, in the assumption (6), is taken positive when it is moving toward the center. In addition, there is a displacement of the point m in a tangential direction, but this quantity may be considered as a higher order term in comparison with ω, and thus be disregarded. The curvature of the element m n after deformation is assumed the same as the curvature of the element m_1 n_1 included between the radii m o and n o . This latter curvature is given by the equation

$$\frac{1}{\rho} = \frac{d\theta + \Delta d\theta}{ds + \Delta ds} \quad , \tag{c}$$

where $d\theta + \Delta d\theta$ denotes the angle between the normal cross section m_1 and n_1 of the deformed bar and $ds + \Delta ds$ denotes the length of the element $m_1 n_1$.

In calculating the small quantity, $\Delta d\theta$, which is the angle between the tangent to the center line of m_1 and the perpendicular to the radius mo is $\frac{d\omega}{ds}$. The corresponding angle at the cross section n_1 is:

$$\frac{d\omega}{ds} + \frac{d^2\omega}{ds^2} \, ds \quad , \tag{d}$$

and thus $$\Delta d\theta = \frac{d^2\omega}{ds^2} \, ds \quad .$$

By neglecting the small angle $\frac{d\omega}{ds}$ the length $m_1 n_1$ is found to be

$(R - \omega)d\theta$

and $$\Delta ds = \omega d\theta = - \omega \frac{ds}{R} \tag{e}$$

Substitution of expressions (d) and (e) in equation (c) yields

$$\frac{1}{\rho} = \frac{d\theta + \frac{d^2\omega}{ds^2} ds}{ds\left(1 - \frac{\omega}{R}\right)}$$

Neglecting the higher order quantities results in

$$\frac{1}{\rho} = \frac{1}{R}\left(1 - \frac{\omega}{R}\right) + \frac{d^2\omega}{ds^2} \tag{f}$$

By substituting equation (f) into equation (a), the relationship obtained is

$$\frac{d^2\omega}{ds^2} + \frac{\omega}{R^2} = - \frac{M}{EI} \quad . \tag{g}$$

and the equation for the moment becomes

$$-EI(x)\left(\frac{d^2\omega}{ds^2} + \frac{\omega}{R^2}\right) = M_o - H(y-\eta) + M_a\left(1 - \frac{X}{L}\right) + M_b\left(\frac{X}{L}\right) \quad . \tag{4}$$

Because of assumption (6), equation (4) becomes

$$-EI(x)\frac{d^2\omega}{ds^2} = M_o - H(y-\eta) + M_a\left(1 - \frac{X}{L}\right) + M_b\left(\frac{X}{L}\right) \qquad (5)$$

For the analysis of the arch the vertical displacement of the arch axis is denoted as η as shown in Fig. 1 which may be written as

$$\omega = \eta \sec\theta$$

Hence, $ds = \sec\theta\, dx$

$$\frac{d\omega}{ds} \approx \frac{d\eta}{ds}\sec\theta = \frac{d\eta}{dx} \quad ,$$

and

$$\frac{d^2\omega}{ds^2} = \frac{d}{ds}\left(\frac{d\eta}{dx}\right) = \frac{d^2\eta}{dx^2}\,\frac{1}{\sec\theta} \quad .$$

Without the loss of generality, the function for the moment of inertia may be written as

$$I(x) = I_o\tau(x) \quad , \qquad (h)$$

in which I_o is the moment of inertia at the crown of the arch.

Upon the substitution of equation (h), equation (5) yields

$$-EI_o\tau(x)\frac{1}{\sec\theta}\frac{d^2\eta}{dx^2} = M_o - Hy + H\eta + M_a\left(1 - \frac{X}{L}\right) + M_b\left(\frac{X}{L}\right) \qquad (6)$$

Defining $G(x) = \tau(x)\cos\theta$, Eq. (6) yields

$$G(x)\frac{d^2\eta}{dx^2} = \frac{-1}{L^2}\left(\frac{HL^2}{EI_o}\right)\eta + f(x) + \frac{Hy}{EI_o} \quad , \qquad (6')$$

where the function $f(x)$ is

$$f(x) = \frac{-1}{EI_o}\left(M_o(x) + M_a\left(1 - \frac{X}{L}\right) + M_b\frac{X}{L}\right) \quad . \qquad (7)$$

In equation (6') the first term on the right-hand side is the moment due to deflection and the horizontal thrust, while the second term is the end moment, and the last term is the moment due to the arch action.

In turn, Eq. (6') can be expressed in the following form:

$$G(x)\frac{d^2\eta}{dx^2} + \frac{1}{L^2}\left(\frac{HL^2}{EI_o}\right)\eta = f(x) + \frac{Hy}{EI_o} \qquad (8)$$

In order to eliminate redundant elements M_o, M_a, M_b and H, equation (8) is differentiated twice with respect to x, and gives the following fourth order differential equation

$$G(x)\frac{d^4\eta}{dx^4} + 2G'\frac{d^3\eta}{dx^3} + \left(G''(x) + \left(\frac{HL^2}{EI_o}\right)\frac{1}{L^2}\right)\frac{d^2\eta}{dx^2}$$

$$= \frac{q(x)}{EI_o} + \frac{Hy''}{EI_o} \tag{9}$$

The boundary conditions for the fixed end arch are

$$\eta(0) = \eta(L) = 0 \quad ,$$

$$\eta'(0) = \eta'(L) = 0 \quad , \tag{10}$$

where the prime denotes differentiation with respect to x.

Since the quantity H in Eq. (9) is unknown, an additional constraint condition is required. The constraint condition is that the sum of horizontal displacement through the span length L is assumed to be zero, i.e.,

$$\int_o^L \eta' y' dx = 0 \tag{11}$$

Now Eqs. (9), (10), and (11) form a boundary value problem.

LINEARIZATION OF EQUATION

Equation (9) is a fourth order differential equation with variable coefficients. The quantity H is also a function of vertical deflection η. Thus Eq. (9) is a nonlinear problem. In order to provide comprehensive fundamental information for the rational design of an arch, the solution to this problem should be valid for all kinds of loads. To attack directly this complex nonlinear problem will be difficult to achieve. Therefore, the following linearization technique is introduced. Let λ be defined as

$$\lambda^2 = \frac{H_R L^2}{EI_o}$$

which is a dimensionless quantity. H_R is an assumed horizontal reaction.* With the dimensionless quantity λ, the Eq. (9) can be expressed as the following

$$G(x)\frac{d^4\eta}{dx^4} + 2G'(x)\frac{d^3\eta}{dx^3} + \left(G''(x) + \frac{\lambda^2}{L^2}\right)\frac{d^2\eta}{dx^2} = \frac{q(x)}{EI_o} + \frac{Hy''}{EI_o} \qquad (13)$$

Now Eq. (13) is a fourth order linear differential equation with variable coefficients for a given parameter λ.

Since the differential equation is linear, the superposition principle is appliable. Thus, the vertical deflection can be defined as the sum of the following two components.

$$\eta = \eta_w + H\,\eta_h \quad , \qquad (14)$$

which η_w is the deflection due to external loads, and η_h is the deflection due unit horizontal thrust. Upon the substitution of Eq. (14) in (13), it

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* In general H_R is the total effect due to various loads which includes dead load, live load, temperature, etc.

becomes

$$G(x)\frac{d^4\eta_w}{dx^4} + 2G'(x)\frac{d^3\eta_w}{dx^3} + \left(G''(x) + \frac{\lambda^2}{L^2}\right)\frac{d^2\eta_w}{dx^2} = \frac{q(x)}{EI_o} \tag{15a}$$

$$G(x)\frac{d^4\eta_h}{dx^4} + 2G'(x)\frac{d^3\eta_h}{dx^3} + \left(G''(x) + \frac{\lambda^2}{L^2}\right)\frac{d^2\eta_h}{dx^2} = \frac{y''}{EI_o} \tag{15b}$$

The boundary conditions are

$$\eta_w(0) = \eta_w'(0) = \eta_w(L) = \eta_w'(L) = 0$$

for Eq. (15a), and

$$\eta_h(0) = \eta_h'(0) = \eta_h(L) = \eta_h'(L) = 0$$

for Eq. (15b).

NONDIMENSIONALIZATION OF DIFFERENTIAL EQUATIONS

In this report, a parabolic arch is considered. Then, the function of the arch axis is:

$$y = \frac{4f}{L}\left(x - \frac{x^2}{L}\right) \tag{16a}$$

$$y' = \frac{4f}{L}\left(1 - \frac{2x}{L}\right) \tag{16b}$$

$$y'' = \frac{8f}{L^2} \tag{16c}$$

where f is the rise of the arch. Assume the width of cross section is constant through the whole arch, and the depth $h = h_o \sec\theta$ in which h_o is the depth at the crown. Therefore,

$$I = I_o \sec^3\theta$$

$$\tau(x) = \sec^3\theta$$

$$G(x) = \sec^2\theta$$

Recalling that the slope $y' = \tan\theta$, the function G(x) can be expressed as

$$G(x) = 1 + (y')^2 = 1 + 16f^2/L^2\,(1 - 2x/L)^2 \quad , \tag{17a}$$

$$G'(x) = -64f^2/L^3\,(1 - 2x/L) \quad , \tag{17b}$$

and

$$G''(x) = 128f^2/L^4 \tag{17c}$$

For simplicity, the following nondimensional quantities are introduced

$$\xi = x/L \quad ,$$

$$n = f/L \quad ,$$

$$\Phi_w = \frac{\eta_w}{L} \quad ,$$

$$Q(\xi) = \frac{q(x)L^3}{EI_o} \quad ,$$

and

$$\Phi_h = \frac{\eta_h}{L} \quad ,$$

Where η_h is the vertical deflection of arch due to a unit horizontal thrust, and thus Φ_h is the nondimensional vertical deflection due to a unit horizontal thrust, and thus is the nondimensional vertical deflection due to unit horizontal thrust. Substituting these nondimensional quantities into Eq. (15a), Eq. (15b) yields

$$G(\xi) \frac{d^4\Phi_w}{d\xi^4} + 2G'(\xi) \frac{d^3\Phi_w}{d\xi^3} + (G''(\xi) + \lambda^2) \frac{d^2\Phi_w}{d\xi^2} = Q(\xi) \qquad (18a)$$

$$\Phi_w(0) = \Phi_w(1) = \Phi_w'(0) = \Phi_w'(1) = 0$$

$$G(\xi) \frac{d^4\Phi_h}{d\xi^4} + 2G'(\xi) \frac{d^3\Phi_h}{d\xi^3} + (G''(\xi) + \lambda^2) \frac{d^2\Phi_h}{d\xi^2} = -8n\gamma \qquad (18b)$$

$$\Phi_h(0) = \Phi_h(1) = \Phi_h'(0) = \Phi_h'(1) = 0$$

where

$$G(\xi) = 1 + 16n^2 (1 - 2\xi^2)$$

$$G'(\xi) = -64n^2 (1 - 2\xi)$$

$$G''(\xi) = 128n^2$$

$$\gamma = \frac{L^2}{EI_o}$$

METHOD OF ANALYSIS[5]

Any n^{th} - order linear differential equation may be reduced to n simultaneous first order equations.

$$\frac{d\Phi_1}{d\xi} = f_1\ (\Phi_1, \Phi_2, \ \cdots\ \Phi_n, \xi) \quad ,$$

$$\frac{d\Phi_2}{d\xi} = f_2\ (\Phi_1, \Phi_2, \ \cdots\ \Phi_n, \xi) \quad ,$$

$$\vdots$$

$$\frac{d\Phi_n}{d\xi} = f_n\ (\Phi_1, \Phi_2, \ \cdots\ \Phi_n, \xi) \quad , \tag{19}$$

which can be conveniently written in the vector form

$$\frac{d\Phi_i}{d\xi} = f_i\ (\Phi_j, \xi) \qquad (i, j = 1, 2, 3, \ldots, n) \tag{20}$$

where f_i are linear function of Φ_i.

The n boundary conditions which are needed to specify a unique solution of Eq. (19) are given at points $\xi = \xi_o$ and n - m conditions are given at $\xi = \xi_1$ i.e.

$$\Phi_p\ (\xi_o) = \alpha_p \qquad P = 1, 2, \ \ldots, m \tag{21a}$$

$$\Phi_q\ (\xi_1) = \beta_q \qquad q = m + n, \ldots, n \tag{21b}$$

Where α_p and β_q are given initial and final values.

The system of differential equation (20) is linear, and its solution can be obtained by the principle of superposition. A particular solution can be obtained by integrating Eq. (20) from the left with the n initial values at $\xi = \xi_o$; the m of them are given in Eqs. (21a), and the remainders are assumed to be zero. Besides the particular solution, there exist n - m nontrivial homogenous solutions. The initial values for the set of homogenous

solutions may be assumed as

$$\Phi_{i(j)}(\xi)\Big|_{\xi=\xi_o} = H_{ij}(\xi)\Big|_{\xi=\xi_o} = \delta_{ij} \quad i = 1,2,\ldots,n \tag{22}$$

where the subscripts of homogenous solutions denote the j - th homogenous solution of the i - th component of the solution vector $\Phi_i(\xi)$, and the subscript j ranges over those numbers associated with components of unspecified initial value of the vector Φ_i, and δ_{ij} is the Kronecker delta.

The solution of Eq. (20) can thus be expressed in the following form

$$\Phi_i(\xi)\Big|^{\ell} = P_i^{\ell}(\xi) + \sum_j^{\overline{n-m}} C_j H_{ij}^{\ell}(\xi) \quad , \tag{23}$$

where the n - m integration constants C_j^{ℓ} are unknown quantities.

For the same reason, a particular solution can be obtained by integrating Eq. (20) from the right with the initial values at $\xi = \xi_1$, which include those given in Eqs. (21b) and the m unknown initial assumed values are zero. Also there exist m nontrivial homogenous solutions with the following assumed initial value set

$$\Phi_{i(j)}(\xi)\Big|_{\xi=\xi_1} = H_{ij}(\xi)\Big|_{\xi=\xi_1} = \delta_{ij} \quad (i = 1,2,3,\ldots,n) \tag{24}$$

Thus, a solution for Eq. (20) can be expressed as

$$\Phi_i(\xi)\Big|^{r} = P_i^r(\xi) + \sum_j^{\overline{m}} C_{ij}^r H_{ij}^r(\xi) \quad , \tag{25}$$

where the m integration constants C_j^r are unknown.

The n - m unknown constants of Eq. (23) can be determined by the requirement that the values of Φ_i at the meeting point $\xi = \xi_2$, found by integration from the left $\Phi_i\Big|^{\ell}$, and those found by integration from the right

$\Phi_i \Big|^r$, must satisfy the continuity conditions and discontinuity conditions at $\xi = \xi_2$. The final solution of Eq. (20) is obtained by substituting C's into Eq. (24) (or Eq. (25)).

SOLUTION FOR A FIXED END ARCH

The basic differential equations describing an elastic arch with fixed ends as Eq. (18) can be replaced by two equivalent systems of four differential equations of first order.

(I) THE EFFECTS DUE TO EXTERNAL LOADS $\bar{\Phi}_w$

By the substitution of the following quantities,

$$\left[\Phi_w,\ \Phi_w',\ \Phi_w'',\ \Phi_w'''\right] = \left[\Theta_1,\ \Theta_2,\ \Theta_3,\ \Theta_4,\right] = \vec{\Theta}$$

Eq. (18a) yields the following system.

$$\frac{d\Theta_1}{d\xi} = \Theta_2 \quad ,$$

$$\frac{d\Theta_2}{d\xi} = \Theta_3 \quad ,$$

$$\frac{d\Theta_3}{d\xi} = \Theta_4 \quad ,$$

$$G\,\frac{d\Theta_4}{d\xi} = -\left[\left(G'' + \lambda\right)\Theta_3 + 2G'\,\Theta_4 - Q\right] \quad , \tag{26}$$

and the boundary conditions are

$$\Theta_1(0) = \Theta_2(0) = \Theta_1(1) = \Theta_2(1) = 0 \quad , \tag{27}$$

If the meeting point is chosen at the loading point $\xi_2 = \bar{\xi}$, Eq. (26) in the domain $\left[0,\xi_2\right]$ and $\left[\xi_2,1\right]$ is homogenous. The following sets of initial values of Θ_i for two homogenous solutions are assumed

$$\overset{1}{\vec{\Theta}}(0) = \begin{bmatrix}0\\0\\1\\0\end{bmatrix} \quad , \qquad \overset{2}{\vec{\Theta}}(0) = \begin{bmatrix}0\\0\\0\\1\end{bmatrix}$$

and

$$\vec{\Theta}^{3}(1) = \begin{bmatrix} 0 \\ 0 \\ 1 \\ 0 \end{bmatrix} \quad , \quad \vec{\Theta}^{4}(1) = \begin{bmatrix} 0 \\ 0 \\ 0 \\ 1 \end{bmatrix}$$

Then by integration from two ends, the solutions of Eq. (18a) can thus be expressed in the following form

$$\vec{\Theta}(\xi)\Big|^{\ell} = C_1 \vec{\Theta}^{1\ell} + C_2 \vec{\Theta}^{2\ell} \quad , \tag{28a}$$

$$\vec{\Theta}(\xi)\Big|^{r} = C_3 \vec{\Theta}^{3r} + C_4 \vec{\Theta}^{4r} \tag{28b}$$

The constants C_1, C_2, C_3 and C_4 are determined by the continuity and discontinuity conditions at the loading point, $\xi = \bar{\xi}$. The conditions are

$$\begin{aligned} \Theta_1\Big|^{\ell}_{\xi=\bar{\xi}} &= \Theta_1\Big|^{r}_{\xi=\bar{\xi}} \quad , \\ \Theta_2\Big|^{\ell}_{\xi=\bar{\xi}} &= \Theta_2\Big|^{r}_{\xi=\bar{\xi}} \quad , \\ \Theta_3\Big|^{\ell}_{\xi=\bar{\xi}} &= \Theta_3\Big|^{r}_{\xi=\bar{\xi}} \quad , \end{aligned} \tag{29}$$

and

$$\left[G'(\bar{\xi})\ \Theta_3^{\ell} + G(\bar{\xi})\ \Theta_4^{\ell}\ (\bar{\xi})\right] + \left[G'(\bar{\xi})\ \Theta_3^{r}\ (\bar{\xi}) + G(\bar{\xi})\ \Theta_4^{r}\ (\bar{\xi})\right] = 1,$$

which means that the first three equations are the continuity conditions of deflection, slope and moment due to the effects of external loads, and the last equation is the discontinuity condition of shear due to the effects of external loads.

The solution of Eq. (18a) is obtained by the substitution of integration constants, C_1, C_2, or C_3, C_4 into Eq. (28a) or (28b) respectively.

(II) THE EFFECTS DUE TO UNIT HORIZONTAL ARCH REACTION $\bar{\Phi}_h$

Bt the substitution of the following quantities

$$\left(\Phi_h,\ \Phi_h',\ \Phi_h'',\ \Phi_h'''\right) = \left(\bar{\Psi}_1,\ \bar{\Psi}_2,\ \bar{\Psi}_3,\ \bar{\Psi}_4,\right) = \vec{\bar{\Psi}} \quad ,$$

Eq. (18b) yields the following system

$$\begin{aligned}
\frac{d\bar{\Psi}_1}{d\xi} &= \bar{\Psi}_2 \quad , \\
\frac{d\bar{\Psi}_2}{d\xi} &= \bar{\Psi}_3 \quad , \\
\frac{d\bar{\Psi}_3}{d\xi} &= \bar{\Psi}_3 \quad , \\
G\,\frac{d\bar{\Psi}_4}{d\xi} &= -\left[\left(G'' + \lambda\right)\bar{\Psi}_3 + 2G'\,\Psi_4 + 8n\gamma\right] \quad ,
\end{aligned} \tag{30}$$

and the boundary conditions are

$$\bar{\Psi}_1(0) = \bar{\Psi}_2(0) = \bar{\Psi}_1(1) = \bar{\Psi}_2(1) = 0 \tag{31}$$

Since the structure and loading conditions are symmetric in this case, therefore the boundary conditions can be changed to

$$\bar{\Psi}_1(0) = \bar{\Psi}_2(0) = \bar{\Psi}_2(\tfrac{1}{2}) = \bar{\Psi}_4(\tfrac{1}{2}) = 0 \quad . \tag{32}$$

The following sets of initial values of $\bar{\Psi}_i$ are assumed

$$\bar{P}(0) = \begin{bmatrix}0\\0\\0\\0\end{bmatrix} \quad , \quad \underset{\sim}{\bar{\Psi}}^{1}(0) = \begin{bmatrix}0\\0\\1\\0\end{bmatrix} \quad , \quad \underset{\sim}{\bar{\Psi}}^{2}(0) = \begin{bmatrix}0\\0\\0\\1\end{bmatrix} \quad ,$$

$\bar{P}(0)$ is for particular solution part and $\underset{\sim}{\bar{\Psi}}^{1}(0)$, $\underset{\sim}{\bar{\Psi}}^{2}(0)$ are for the homogenous part. Then by integration from left hand side, $\xi = 0$, to the crown of the arch the solution of Eq. (18b) can thus be expressed in the following form

$$\vec{\bar{\Psi}}(\xi) = \vec{\bar{P}}(\xi) + D_1\underset{\sim}{\bar{\Psi}}^{1}(\xi) + D_2\underset{\sim}{\bar{\Psi}}^{2}(\xi) \tag{33}$$

By using the symmetric conditions that are slope and shear due to a unit

horizontal arch reaction equal zero at the center $\xi = \frac{1}{2}$. i.e.

$$\begin{aligned} \overline{\Psi}_2(\tfrac{1}{2}) &= P_2(\tfrac{1}{2}) + D_1 \overset{1}{\overline{\Psi}}_2(\tfrac{1}{2}) + D_2 \overset{2}{\overline{\Psi}}_2(\tfrac{1}{2}) \\ \overline{\Psi}_4(\tfrac{1}{2}) &= P_4(\tfrac{1}{2}) + D_1 \overset{1}{\overline{\Psi}}_4(\tfrac{1}{2}) + D_2 \overset{2}{\overline{\Psi}}_4(\tfrac{1}{2}) \end{aligned} \tag{34}$$

Then the solution of Eq. (18b) is obtained by the substitution of D_1 and D_2 into Eq. (33).

GREEN'S FUNCTION

The solutions for the sets of Eq. (26) and Eq. (30) are obtained with an assumed value λ, which is related to H by Eq. (12). In order to obtain the solution of Eq. (13), the horizontal arch reaction H must be found first by using the following constraint condition.

$$\int_o^L \eta' y' dx = 0 \quad , \tag{11}$$

which may be rewritten in the nondimensional form as

$$\int_o^1 \left(\Theta_2 + H\bar{\Psi}_2\right) y'(\xi) d\xi = 0. \tag{38}$$

Now the nondimensional function for η can be expressed as

$$\Phi_i = \Theta_i + H\bar{\Psi}_i \quad . \qquad (i = 1,2,3,4) \tag{39}$$

Thus the Green's functions for bending moment M, vertical shearing force V, thrust force TH, and transversal shear (parallel to the cross section of the arch) TV in the given arch due to a single unity load across the span are

$$M(\xi,\bar{\xi};\lambda) = -G(\xi)\ \Phi_3(\xi,\bar{\xi};\lambda) \quad ,$$

$$V(\xi,\bar{\xi};\lambda) = \frac{dM}{d\xi} = -\left[G(\xi)\ \Phi_4(\xi,\bar{\xi};\lambda) + G'(\xi)\ \Phi_3(\xi,\bar{\xi};\lambda)\right]$$

$$TH(\xi,\bar{\xi};\lambda) = H(\xi,\lambda)\ \cos[\theta(\xi)] + V(\xi,\bar{\xi},\lambda)\ \sin[\theta(\xi)] \tag{40}$$

and

$$TV(\xi,\bar{\xi},\lambda) = \frac{dM(\xi,\bar{\xi},\lambda)}{ds} = \cos[\theta(\xi)]\ \frac{d}{d\xi}\ [M(\xi,\bar{\xi},\lambda]$$

Now the Green's functions of generalized forces are obtained for assumed λ. The Green's functions for moment, thrust and sectional shear for each section under assumed values of λ are calculated and tabulated in Appendix 2 for a special value of rise ratio n = f/L = 0.2. The λ's values are assumed as $0.\pi$, 0.2π, 0.4π, 0.6π, 0.8π, π, 1.2π and 1.4π.

OUTLINE THE PROCEDURE FOR DESIGN WORK

With these Green's functions, the preparation work for the stresses at a certain section can be determined by following the steps indicated:

Step 1^0.

Using Green's functions $M(\xi,\bar{\xi},\lambda)$, the critical loading conditions with an assumed value of λ, at a section of the arch are determined.

Step 2^0.

Under these critical loading conditions, the bending moment $M(\xi,\lambda)$, horizontal reaction $H_R(\xi,\lambda)$, thrust force $TH(\xi,\lambda)$ and transversal shearing force $TV(\xi,\lambda)$ at the section ξ are calculated by use of the set of Green's functions.

Step 3^0.

With the result $H_R(\xi,\lambda)$ obtained, by Eq. (12), a set of computed value of λ^* is obtained

$$\lambda^* = \sqrt{\frac{H_R L^2}{EI_o}}$$

Step 4^0.

A curve for (λ,λ^*) is plotted as shown in Fig. 4. The true value of λ_o can be determined as follows:

(a) Draw a straight line through the origin of the coordinates with a slope 45^o.

(b) The intersection point of the straight line and the curve (λ,λ^*) satisfies the condition

$$\lambda^* = \lambda = \lambda_o$$

(c) Thus the true value of λ_o is determined.

Step 5^0.

Use interpolation technique, the bending moment M, thrust

force TH and the transversal shearing force TV at a section of interest are readily determined.

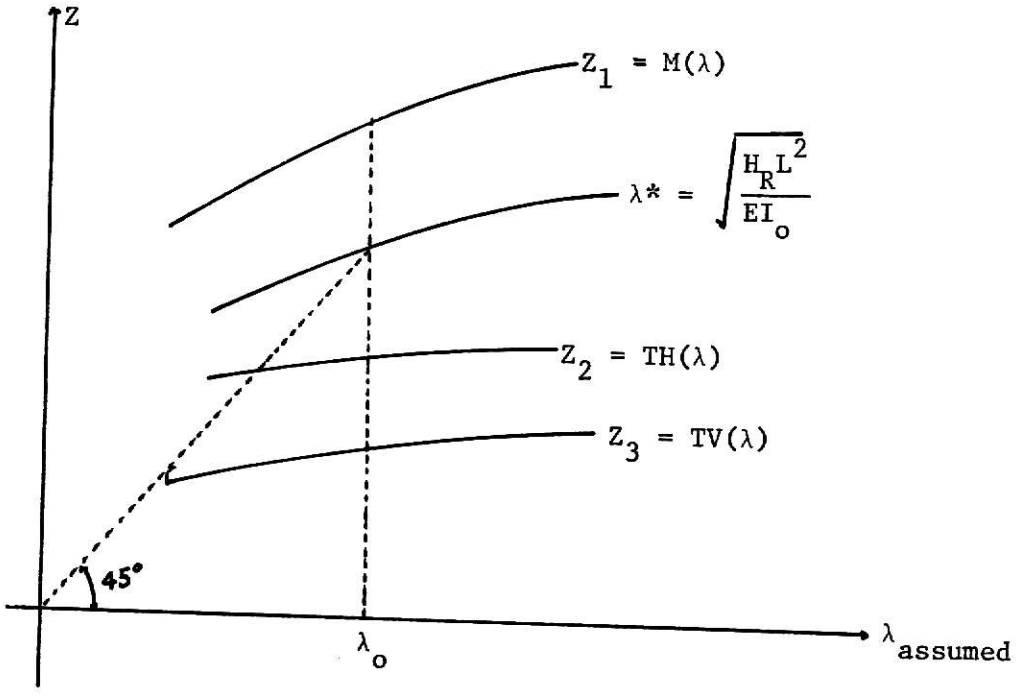

Figure 4

NUMERICAL EXAMPLE

For a numerical example, consider a fixed ends arch with parabolic arch axis described by Eq. (16a). The moment of inertia of the cross sections varies according to the following rule

$$I = I_o \sec^3\theta(x)$$

The ratio of the rise and the span length of the arch is 0.2. The span length is 600 ft. and EI_o is chosen as 6×10^6 kip - ft. The EI value at each section is tabulated in Table 1. 2 kips per foot is assumed for dead load uniformly distributed over the full span of the arch. Two kinds of live loads are considered; (a) One is the 1 kip per foot of uniformly distributed load over the region which causes the maximum positive moment at the section of interest; (b) The other one is the 1 kip per foot of uniformly distributed load over the region which causes the maximum negative moment at the section of interest.

Then following Step 1^0 and Step 2^0 described in the previous section, the horizontal reaction, thrust force and bending moment which are functions of parameter λ, for each section under the critical loading conditions are obtained. The numerical values are tabulated in Table 2 and Table 3. By the application of Step 3^0, the actual value λ for each section is obtained. The actual forces at each section are obtained by applying the interpolation technique in Step 4^0. Fig. 5 through Fig. 8 illustrates the method used to find the actual forces for sections 1 and 11 under loading conditions (a) and (b).

ILLEGIBLE DOCUMENT

THE FOLLOWING DOCUMENT(S) IS OF POOR LEGIBILITY IN THE ORIGINAL

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Table 1.

EI= 0.60000000D 07

EI AT SECTION 1= 0.12601348D 08

EI AT SECTION 2= 0.11226142D 08

EI AT SECTION 3= 0.10041419D 08

EI AT SECTION 4= 0.90332903D 07

EI AT SECTION 5= 0.81888090D 07

EI AT SECTION 6= 0.74961496D 07

EI AT SECTION 7= 0.69448052D 07

EI AT SECTION 8= 0.65257949D 07

EI AT SECTION 9= 0.62318684D 07

EI AT SECTION 10= 0.60576921D 07

EI AT SECTION 11= 0.60000000D 07

THE EFFECT OF DEAD LOAD AND POSTIVE LIVE LOAD - Table 2.

AT SECTION 1

LAMDA	MOMENT	H-REACTION	THRUST
0.39383066D 01	0.68616026D 04	0.25850432D 03	0.25792548D 03
0.39381253D 01	0.68784420D 04	0.25848052D 03	0.25785736D 03
0.39375799D 01	0.69297195D 04	0.25840839D 03	0.25765043D 03
0.39366403D 01	0.70178068D 04	0.25828569D 03	0.25729673D 03
0.39352893D 01	0.71469942D 04	0.25810837D 03	0.25678197D 03
0.39334731D 01	0.73240855D 04	0.25787017D 03	0.25608365D 03
0.39311203D 01	0.75594503D 04	0.25756178D 03	0.25516793D 03
0.39281249D 01	0.78688748D 04	0.25716942D 03	0.25398395D 03

AT SECTION 3

LAMDA	MOMENT	H-REACTION	THRUST
0.34582584D 01	0.18220745D 04	0.19932586D 03	0.21471806D 03
0.34582176D 01	0.18293272D 04	0.19932115D 03	0.21491388D 03
0.34580843D 01	0.18514576D 04	0.19930579D 03	0.21551878D 03
0.34578259D 01	0.18896318D 04	0.19927599D 03	0.21659025D 03
0.33857361D 01	0.19714706D 04	0.19105349D 03	0.19288658D 03
0.33869710D 01	0.20491646D 04	0.19119298D 03	0.19537921D 03
0.33883546D 01	0.21534448D 04	0.19134911D 03	0.19909553D 03
0.33897893D 01	0.22921733D 04	0.19151119D 03	0.20490183D 03

AT SECTION 5

LAMDA	MOMENT	H-REACTION	THRUST
0.20571466D 01	0.23766360D 04	0.70530871D 02	0.89019213D 02
0.20569382D 01	0.23827704D 04	0.70520011D 02	0.89182315D 02
0.20565104D 01	0.24014020D 04	0.70487251D 02	0.89685341D 02
0.20557053D 01	0.24332407D 04	0.70432069D 02	0.90572664D 02
0.20545608D 01	0.24795591D 04	0.70353669D 02	0.91930568D 02
0.20530632D 01	0.25423482D 04	0.70251144D 02	0.93912685D 02
0.20512017D 01	0.26245908D 04	0.70123806D 02	0.96796697D 02
0.20489783D 01	0.27307359D 04	0.69971904D 02	0.10112312D 03

AT SECTION 7

LAMDA	MOMENT	H-REACTION	THRUST
0.27871248D 01	0.31553412D 04	0.12946774D 03	0.13531106D 03
0.27872145D 01	0.31684130D 04	0.12947603D 03	0.13546925D 03
0.27874849D 01	0.32082764D 04	0.12950120D 03	0.13596008D 03
0.27879478D 01	0.32769579D 04	0.12954421D 03	0.13683658D 03
0.27886213D 01	0.33781304D 04	0.12960682D 03	0.13820342D 03
0.27895364D 01	0.35176352D 04	0.12969188D 03	0.14025114D 03
0.27907416D 01	0.37044084D 04	0.12980392D 03	0.14333364D 03
0.27923109D 01	0.39521137D 04	0.12995000D 03	0.14816156D 03

AT SECTION 9

LAMDA	MOMENT	H-REACTION	THRUST
0.336902240 01	0.239072980 04	0.189171870 03	0.188594540 03
0.336986550 01	0.240105390 04	0.189268810 03	0.188737570 03
0.337232980 01	0.243265300 04	0.189543360 03	0.189157660 03
0.337597770 01	0.248744950 04	0.189953760 03	0.189836570 03
0.338037090 01	0.256862770 04	0.190448460 03	0.190768910 03
0.338509090 01	0.268202940 04	0.190980670 03	0.191992310 03
0.338982710 01	0.283493690 04	0.191515460 03	0.193631650 03
0.340090210 01	0.303992220 04	0.192768920 03	0.196706730 03

AT SECTION 11

LAMDA	MOMENT	H-REACTION	THRUST
0.311944110 01	0.176863800 04	0.162181880 03	0.162181880 03
0.312041230 01	0.177340370 04	0.162282880 03	0.162282880 03
0.312334630 01	0.178785540 04	0.162588200 03	0.162588200 03
0.312830550 01	0.181246880 04	0.163104920 03	0.163104920 03
0.313539910 01	0.184808150 04	0.163845460 03	0.163845460 03
0.314479210 01	0.189596690 04	0.164828620 03	0.164828620 03
0.315671900 01	0.195795740 04	0.166081250 03	0.166081250 03
0.317156780 01	0.203664520 04	0.167641030 03	0.167641030 03

ACTUAL STRESSES AT EACH SECTION

LAMDA	MOMENT	THRUST
0.457213300 01	0.763846380 04	0.254865600 03
0.437119540 01	0.208997930 04	0.196833760 03
0.273715210 01	0.244580520 04	0.909410120 02
0.389201860 01	0.343935460 04	0.139102100 03
0.436833140 01	0.274173720 04	0.192632450 03
0.315789990 01	0.189628870 04	0.164835120 03

THE EFFECT OF DEAD LOAD AND NEGATIVE LIVE LOAD

AT SECTION 1

LAMDA	MOMENT	H-REACTION	THRUST
0.26721079D 01	-0.68609878D 04	0.11900286D 03	0.22551590D 03
0.26723721D 01	-0.68778774D 04	0.11902621D 03	0.22558366D 03
0.26731668D 01	-0.69293071D 04	0.11909701D 03	0.22578952D 03
0.26745193D 01	-0.70176551D 04	0.11921756D 03	0.22614146D 03
0.26764749D 01	-0.71472236D 04	0.11939197D 03	0.22665385D 03
0.26791037D 01	-0.73248395D 04	0.11962661D 03	0.22734925D 03
0.26825098D 01	-0.75609166D 04	0.11993098D 03	0.22826163D 03
0.26868461D 01	-0.78713286D 04	0.12031993D 03	0.22944199D 03

AT SECTION 3

LAMDA	MOMENT	H-REACTION	THRUST
0.32696910D 01	-0.18217583D 04	0.17618132D 03	0.22805423D 03
0.32697301D 01	-0.18290411D 04	0.17618558D 03	0.22841083D 03
0.32698589D 01	-0.18512640D 04	0.17819962D 03	0.22950815D 03
0.32701124D 01	-0.18895991D 04	0.17822725D 03	0.23143482D 03
0.33446690D 01	-0.19716794D 04	0.18644685D 03	0.25971964D 03
0.33433658D 01	-0.20497174D 04	0.18630381D 03	0.26391066D 03
0.33419483D 01	-0.21544848D 04	0.18614365D 03	0.26994013D 03
0.33404545D 01	-0.22939236D 04	0.18597727D 03	0.27886206D 03

AT SECTION 5

LAMDA	MOMENT	H-REACTION	THRUST
0.42916871D 01	-0.23765290D 04	0.30697630D 03	0.33003655D 03
0.42917599D 01	-0.23826778D 04	0.30698672D 03	0.33050228D 03
0.42919796D 01	-0.24013534D 04	0.30701815D 03	0.33196502D 03
0.42923502D 01	-0.24332691D 04	0.30707117D 03	0.33457406D 03
0.42928778D 01	-0.24797038D 04	0.30714666D 03	0.33863739D 03
0.42935694D 01	-0.25426600D 04	0.30724564D 03	0.34471952D 03
0.42944309D 01	-0.26251410D 04	0.30736895D 03	0.35387937D 03
0.42954619D 01	-0.27316363D 04	0.30751655D 03	0.36827048D 03

AT SECTION 7

LAMDA	MOMENT	H-REACTION	THRUST
0.38577670D 01	-0.31553557D 04	0.24803943D 03	0.26151571D 03
0.38576990D 01	-0.31684299D 04	0.24803970D 03	0.26177510D 03
0.38574930D 01	-0.32083004D 04	0.24804020D 03	0.26258209D 03
0.38571417D 01	-0.32769925D 04	0.24795903D 03	0.26403104D 03
0.38566321D 01	-0.33781771D 04	0.24789352D 03	0.26630960D 03
0.38559427D 01	-0.35176916D 04	0.24780490D 03	0.26976288D 03
0.38550396D 01	-0.37044647D 04	0.24768894D 03	0.27504058D 03
0.38538691D 01	-0.39521441D 04	0.24753645D 03	0.28346800D 03

AT SECTION 9

LAMDA	MOMENT	H-REACTION	THRUST
0.33615649D 01	-0.23907937D 04	0.18833531D 03	0.19411109D 03
0.33604997D 01	-0.24011125D 04	0.18823792D 03	0.19409868D 03
0.33582320D 01	-0.24326939D 04	0.18796284D 03	0.19408547D 03
0.33545445D 01	-0.24874555D 04	0.18754948D 03	0.19413991D 03
0.33500914D 01	-0.25687713D 04	0.18705187D 03	0.19436267D 03
0.33452933D 01	-0.26819648D 04	0.18651612D 03	0.19489909D 03
0.33404547D 01	-0.28345834D 04	0.18597730D 03	0.19596248D 03
0.33291398D 01	-0.30392287D 04	0.18471953D 03	0.19722361D 03

AT SECTION 11

LAMDA	MOMENT	H-REACTION	THRUST
0.35943731D 01	-0.17687065D 04	0.21532530D 03	0.21532530D 03
0.35935262D 01	-0.17734637D 04	0.21522385D 03	0.21522385D 03
0.35909653D 01	-0.17878874D 04	0.21491720D 03	0.21491720D 03
0.35866279D 01	-0.18124462D 04	0.21439832D 03	0.21439832D 03
0.35804039D 01	-0.18479629D 04	0.21365487D 03	0.21365487D 03
0.35721268D 01	-0.18956833D 04	0.21266817D 03	0.21266817D 03
0.35615573D 01	-0.19573881D 04	0.21141151D 03	0.21141151D 03
0.35483581D 01	-0.20355634D 04	0.20984742D 03	0.20984742D 03

ACTUAL STRESSES AT EACH SECTION

LAMDA	MOMENT	THRUST
0.33327079D 01	-0.71925518D 04	0.22683523D 03
0.41482559D 01	-0.20832881D 04	0.26584269D 03
0.63968219D 01	-0.27141893D 04	0.36591280D 03
0.41947624D 01	-0.37379595D 04	0.27618026D 03
0.41523029D 01	-0.27309973D 04	0.19524120D 03
0.52586512D 01	-0.19372650D 04	0.21182133D 03

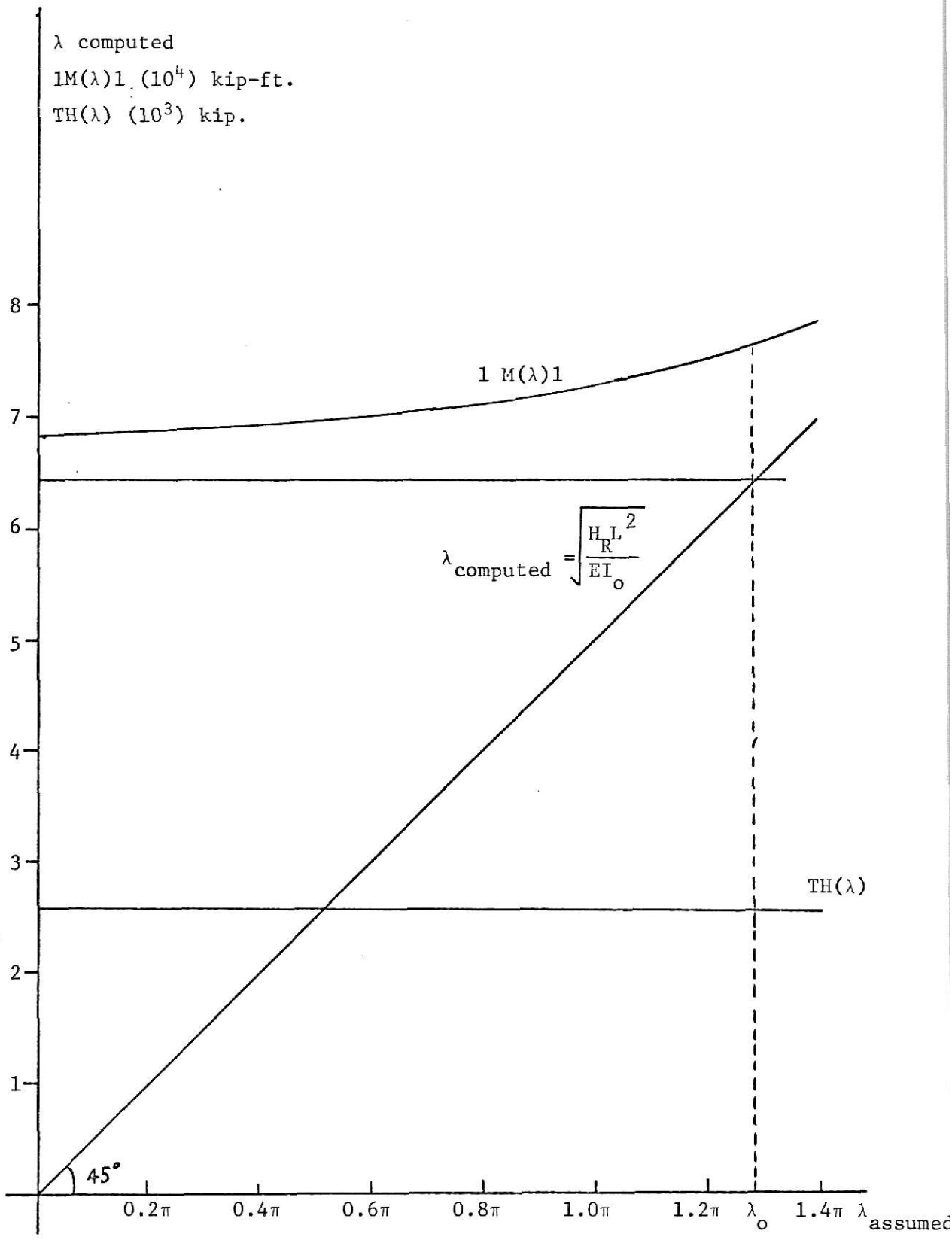

Figure 5. Graphic method to find actual forces for section 1 under loading condition (a)

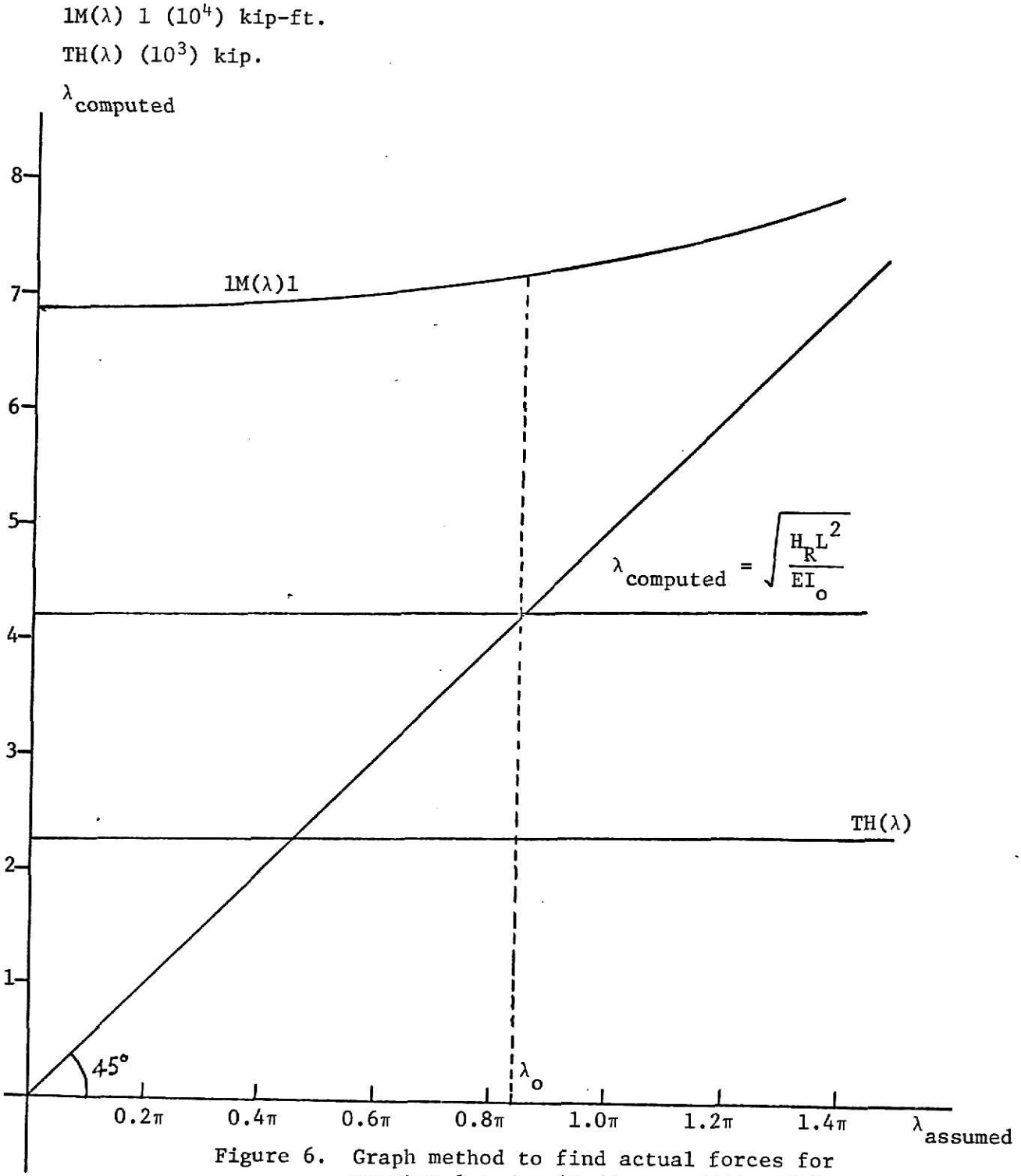

Figure 6. Graph method to find actual forces for section 1 under loading condition (b)

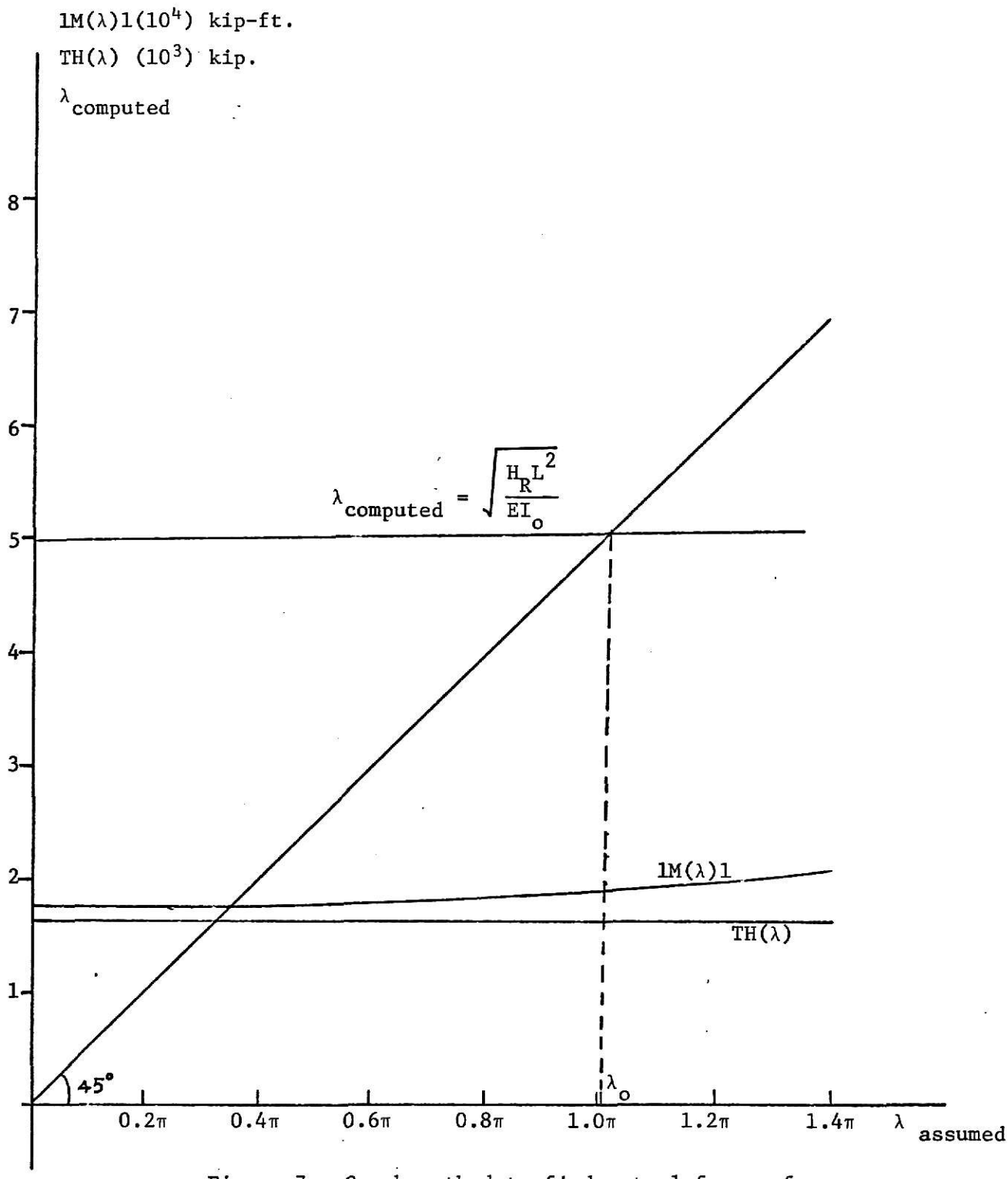

Figure 7. Graph method to find actual forces for section II under loading condition (a)

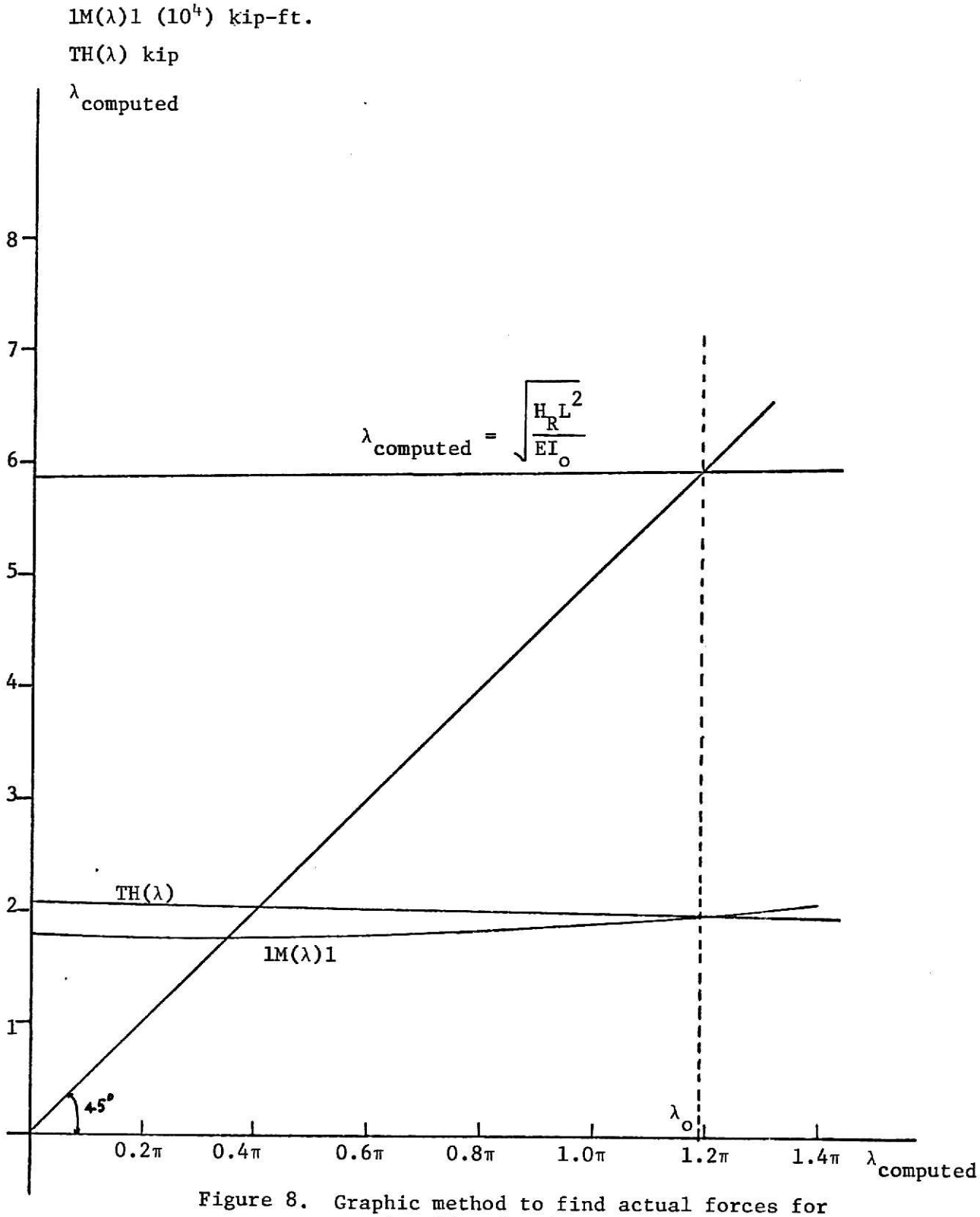

Figure 8. Graphic method to find actual forces for section II under loading condition (b)

CONCLUDING REMARKS

Stress analysis of an arch, in general, is a nonlinear problem, which is so complicated that its solution is difficult to obtain analytically, and thus it may not be practical for design work. For simplicity, a linearization technique is introduced and then the superposition principle is applicable.

Based on the deflection theory, the method used in this report provides the following advantages:

(1) The real critical loading condition for each section of an arch is determined by using a set of Green's functions obtained previously.

(2) The process of calculation is simple and straight forward. Repetitive calculation, which had been used in the analysis of Rainbow Arch Bridge[3], is avoided.

In addition, the elastic stability of an arch with varying rigidity described by Eq. (h) can be studied. The homogenous part of the equation (8) has the same form as the differential equation for beam-column problem. In other words, the elastic stability of a fixed end arch is analogical to that for a beam-column. When the quantity $\frac{H_R L^2}{EI_o}$ is equal to the eigenvalue of the homogenous part of the Eq. (8), or horizontal reaction H reaches to the critical loading, the arch buckles.

Also from Eq. (8), it is seen that the theory used in this report changes from deflection theory to elastic theory if the second term which gives the geometrical change of the arch axis, is neglected, i.e., the λ is equal to zero.

The numerical results show that the bending moments from elastic theory

and deflection theory differ considerable. Table 3 shows the percentage increase of bending moment calculated from the following equation,

$$\text{bending moment increase percentage} = \frac{M_d - M_e}{M_e} \tag{42}$$

in which M_d is the bending moment due to deflection theory and M_e is the bending moment due to elastic theory.

Loading Condition / Section	MOMENT INCREASE PERCENTAGE (%)	
	CASE a	CASE b
1	11.32	4.85
3	14.70	14.36
5	2.91	14.21
7	9.00	18.46
9	14.68	14.23
11	7.40	9.53

Table 3.

ACKNOWLEDGEMENT

The author wishes to express his deep sense of gratitude to his major professor, Dr. C. L. Huang and Dr. K. K. Hu for their guidance, constructive criticism, and the personal interest they have taken in the preparation of this master's report.

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Appendix 1

COMPUTER PROGRAM

```
$JOB            WANG,RUN=NOCHECK,TIME=5,PAGES=60,LINES=60,KP=29
      IMPLICIT INTEGER*4(I-N),REAL*8(A-H,O-Z)
      DIMENSION HH(6,5)
      DIMENSION PSA(8,6,5),SAN(8,6,5),BT(8,6,5)
      DIMENSION T(21),HX(21)
      DIMENSION TWH(4,21),Y(4),DY(4),A(4,5)
      DIMENSION TA(4),AP(4),ANG(4)
      DIMENSION S(4,10,21),SPS(4,21),C(4),SN(21)
      DIMENSION XI(3),FA(3,21),ANV(4),PAV(4)
      DIMENSION PA(3)
      DIMENSION T1(21)
      DIMENSION W3(11,21)
      DIMENSION AN(4),ALM(8),G(21),CN(21),YP(21),GP(21),Q(4),WH(4,4,21)
      DIMENSION TH(6,21), SV(6,21),HF(4,21),W1(6,21),SP(21),ST(6),SS(6)
      DIMENSION U(8,6,5)
      DIMENSION W2(11,21)
      DIMENSION TJP(4)
   61 FORMAT(1HO,20X,'LAMDA=',F9.6)
 1001 FORMAT(1HO,'SECTION ',I3)
 3000 FORMAT (1HO,'EI=',1D16.8)
 2001 FORMAT (1HO,'STRESS FOR CASE 1')
 2003 FORMAT (1HO,'STRESS FOR CASE 2')
 2002 FORMAT(1HO,20X,'MOMEMT',11X,'REACTION',10X,'THRUST',10X,'SHEAR')
   72 FORMAT (5X,5D16.8)
 3100 FORMAT(1HO,'EI AT SECTION',I3,'=',1D16.8)
   62 FORMAT(1HO,20X,'TOTAL AREA',2X,3D16.8)
   65 FORMAT(1HO,20X,'MAX. POINT',2X,3D16.8)
 8001 FORMAT (1H-)
   66 FORMAT (1HO,20X,'MIN. POINT',2X,3D16.8)
  555 FORMAT (15X,2D16.8)
  997 FORMAT (15X,3D16.8)
    1 FORMAT(4F5.2)
    2 FORMAT(8F5.2)
    3 FORMAT (1H1)
  998 FORMAT (31X,2D16.8)
   71 FORMAT(5X,4D16.8)
   75 FORMAT(1HO,23X,'INFLUENCE LINES FOR SECTION ',I3)
   79 FORMAT(8X,2D16.8)
   90 FORMAT(1HO,5X,'THE EFFECT OF DEAD LOAD AND POSTIVE  LIVE LOAD')
   91 FORMAT(1HO,5X,'THE EFFECT OF DEAD LOAD AND NEGATIVE LIVE LOAD')
   78 FORMAT (20X,'MOMENT',11X,'THRUST',10X,'SHEAR')
   85 FORMAT (32X,'(SPECIAL JUMP POINT)')
   70 FORMAT (20X,'MOMENT',11X,'THRUST')
      READ(1,1)(AN(I),I=1,4)
      READ(1,2)(ALM(J),J=1,8)
      II=3
      DO 999 JJ=1,8
      X=0.
      H=1./20.
      DO 278 I=1,21
      G(I)=1.+(4.*AN(II)*(1.-2.*X))**2
```

```
      CN(I)=1./DSQRT(G(I))
      YP(I)=4.*AN(II)*(1.-2.*X)
      SN(I)=YP(I)*CN(I)
      GP(I)=-64.*AN(II)**2*(1.-2.*X)
  278 X=X+H
      ALM(JJ)=3.14159265358*ALM(JJ)
      NEQ=4
      H=1.0/20.0
      DO 101 M=1,2
      MN=M+2
      DO 102 I=1,4
      Q(I)=0.0
  102 Y(I)=0.0
      Y(MN)=1.0
      DO 103 I=1,4
  103 WH(I,M,1)=Y(I)
      X=0.0
      KK=2
      DO 110 I=2,21
      CALL RKG(NEQ,H,X,Y,DY,ALM,AN,Q,KK,JJ,II)
      DO 115 J=1,4
  115 WH(J,M,I)=Y(J)
  110 CONTINUE
  101 CONTINUE
      KK=1
      DO 220 I=1,4
      WH(I,3,1)=0.
      Y(I)=0.
  220 Q(I)=0.
      X=0.
      DO 222 I=2,21
      CALL RKG(NEQ,H,X,Y,DY,ALM,AN,Q,KK,JJ,II)
      DO 225 J=1,4
  225 WH(J,3,I)=Y(J)
  222 CONTINUE
      D=WH(2,1,11)*WH(4,2,11)-WH(2,2,11)*WH(4,1,11)
      D1=-WH(2,3,11)*WH(4,2,11)+WH(2,2,11)*WH(4,3,11)
      D2=-WH(2,1,11)*WH(4,3,11)+WH(2,3,11)*WH(4,1,11)
      C1=D1/D
      C2=D2/D
      DO 233 I=1,4
      I1=I+1
      DO 233 J=1,11
      JK=22-J
      TWH(I,J)=C1*WH(I,1,J)+C2*WH(I,2,J)+WH(I,3,J)
  233 TWH(I,JK)=TWH(I,J)*((-1.0)**I1)
      DO 291 I=1,21
  291 T1(I)=TWH(2,I)*YP(I)
      CALL INTGL(T1,H,AR,21)
      DTH=AR
      DO 235 J=1,21
  235 HF(1,J)=TWH(1,J)/DTH
      DO 503 J=1,21
      HF(3,J)=-G(J)*TWH(3,J)
```

```
  503 HF(4,J)=-GP(J)*TWH(3,J)-G(J)*TWH(4,J)
      DO 502 M=1,2
      MN=M+2
      CI=-1
      DO 502 I=1,4
      CI=CI*(-1)
      DO 502 J=1,21
      K=22-J
  502 WH(I,MN,J)=WH(I,M,K)*CI
      DO 1100 K=2,20
      DO 1110 I=1,3
      DO 1110 L=1,4
 1110 A(I,L)=WH(I,L,K)
      DO 1120 L=1,4
      A(4,L)=-GP(K)*WH(3,L,K)-G(K)*WH(4,L,K)
 1120 A(L,5)=0.0
      DO 1130 I=1,4
      DO 1130 L=3,4
 1130 A(I,L)=-A(I,L)
      A(4,5)=1.0
      CALL GJR(A)
      SP(K)=0.0
      DO 1504 J=1,2
 1504 SP(K)=SP(K)-A(J,5)*(GP(K)*WH(3,J,K)+G(K)*WH(4,J,K))
      DO 1505 I=1,11,2
      I1=(I+1)/2
      SV(I1,K)=0.
      W3(I1,K)=0.
      IF(I.GE.K) GO TO 1525
      DO 1515 J=1,2
      SV(I1,K)=SV(I1,K)-(GP(I)*WH(3,J,I)+G(I)*WH(4,J,I))*A(J,5)
      W2(I1,K)=HF(3,I)*HF(1,K)
      W3(I1,K)=W3(I1,K)-G(I)*A(J,5)*WH(3,J,I)
 1515 W1(I1,K)=W3(I1,K)+W2(I1,K)
      GO TO 1505
 1525 DO 1535 J=3,4
      SV(I1,K)=SV(I1,K)-(GP(I)*WH(3,J,I)+G(I)*WH(4,J,I))*A(J,5)
      W2(I1,K)=HF(3,I)*HF(1,K)
      W3(I1,K)=W3(I1,K)-G(I)*A(J,5)*WH(3,J,I)
 1535 W1(I1,K)=W3(I1,K)+W2(I1,K)
 1505 CONTINUE
 1100 CONTINUE
 1111 DO 1600 I=1,6
      W1(I,1)=0.
      SV(1,1)=0.
      SV(I,21)=0.0
 1600 W1(I,21)=0.0
      SP(1)=1.0
      SV(1,1)=1.0
      DO 1700 I=1,6
      NP=2*I-1
      DO 1760 K=1,21
      TH(I,K)=HF(1,K)*CN(NP)+SV(I,K)*SN(NP)
 1760 SV(I,K)=(SV(I,K)+HF(4,NP)*HF(1,K))*CN(NP)
```

```
      ST(I)=HF(1,NP)*CN(NP)+SP(I)*SN(NP)
 1700 SS(I)=(SP(I)+HF(4,NP)*HF(1,NP))*CN(NP)
      DO 508 I=1,6
      DO 401 J=1,21
      TWH(1,J)=W1(I,J)
      TWH(2,J)=HF(1,J)
      TWH(3,J)=TH(I,J)
  401 TWH(4,J)=SV(I,J)
      NP=2*I-1
      WRITE(3,9001)
      AJJ=(JJ-1)
      AJJ=AJJ*0.2*3.1415927
      WRITE(3,61)AJJ
      WRITE(3,75)NP
      WRITE(3,78)
      WRITE(3,997)(W1(I,J),TH(I,J),SV(I,J),J=1,21)
      IF(I .NE.1)GO TO 499
      GO TO 77
  499 STH=ST(I)
      SSV=SS(I)
      WRITE(3,85)
      WRITE(3,998)STH,SSv
      TJP(3)=STH
      TJP(4)=SSV
   77 CALL TINTGC(NP,TWH,TJP,PA,ANG,PAV,ANV,T)
      DO 814 K=1,3
      PSA(JJ,I,K)=PA(K)
  814 SAN(JJ,I,K)=ANG(K)
      DO 819 K=1,3
  819 BT(JJ,I,K)=T(K)
      WRITE(3,3)
  508 CONTINUE
  599 CONTINUE
      PP=600.
      D=1.3*3.1415927
      EI=6000000.
      WRITE(3,3)
      WRITE(3,8001)
      WRITE(3,90)
      CALL STRESS(PSA,BT,HH,EI)
      WRITE(3,3)
      WRITE(3,8001)
      WRITE (3,91)
      CALL STRESS(SAN,BT,HH,EI)
      WRITE(3,3)
      WRITE(3,8001)
      WRITE(3,3000)EI
      DO 2500 I=1,11
      T(I)=EI*(1./CN(I))**3
 2500 WRITE(3,3100) I,T(I)
      STOP
      END
```

```
      SUBROUTINE GJR(A)
      IMPLICIT INTEGER*4(I-N),REAL*8(A-H,O-Z)
      DIMENSION A(4,5)
  102 FORMAT(5F16.8)
      N=4
      N1=N+1
      DET=1.0
      DO 200 J=1,N
      DIV=A(J,J)
      S=1.0/DIV
      DET=DET*DIV
      DO 201 K=J,N1
  201 A(J,K)=A(J,K)*S
      DO 202 I=1,N
      IF(I-J) 203,202,203
  203 AIJ=-A(I,J)
      DO 204 K=J,N1
  204 A(I,K)=A(I,K)+AIJ*A(J,K)
  202 CONTINUE
  200 CONTINUE
      RETURN
      END
```

```
      SUBROUTINE RKG(NEQ,H,X,Y,DY,ALM,AN,Q,KK,L,II)
      IMPLICIT INTEGER*4(I-N),REAL*8(A-H,O-Z)
      * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
      * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
      THE INDEPENDENT VARIABLE X IS INCREMENTED IN THIS PROGRAM
      Y(I) AND DY(I) ARE THE DEPENDENT VARIABLE AND ITS DERIVATIVE
      ALL THE Q(I) MUST BE INITIALLY SET TO ZERO IN THE MAIN PROGRAM
      NEQ = NUMBER OF FIRST ORDER EQUATIONS
      H = INTERVAL SIZE
      * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
      * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
      DIMENSION  A(2)
      DIMENSION Y(NEQ),DY(NEQ),Q(NEQ),ALM(8),AN(4)
      A(2)=1.7071067811865475
       CN-4
      A(1)=0.2928932188134524
       CN-4
      H2=.5*H
      CALL DERIV (NEQ,X,Y,DY,ALM,AN,Q,KK,L,II)
      DO 13 I=1,NEQ
      B=H2*DY(I)-Q(I)
      Y(I)=Y(I)+B
   13 Q(I)=Q(I)+3.*B-H2*DY(I)
      X=X+H2
      DO 20 J=1,2
      CALL DERIV (NEQ,X,Y,DY,ALM,AN,Q,KK,L,II)
      DO 20 I=1,NEQ
      B=A(J)*(H*DY(I)-Q(I))
      Y(I)=Y(I)+B
   20 Q(I)=Q(I)+3.*B-A(J)*H*DY(I)
      X=X+H2
      CALL DERIV (NEQ,X,Y,DY,ALM,AN,Q,KK,L,II)
      DO 26 I=1,NEQ
      B=0.16666666666666666*(H*DY(I)-2.*Q(I))
       CN-4
      Y(I)=Y(I)+B
   26 Q(I)=Q(I)+3.*B-H2*DY(I)
      RETURN
      END
```

```
      SUBROUTINE DERIV (NEQ,X,Y,DY,ALM,AN,C,KK,JJ,II)
      IMPLICIT INTEGER*4(I-N),REAL*8(A-H,O-Z)
      DIMENSION Y(NEQ),DY(NEQ),ALM(8),AN(4),G(NEQ)
      K=NEQ-1
      DO 100 I=1,K
  100 DY(I)=Y(I+1)
      G=1.+(4.*AN(II)*(1.-2.*X))**2
      GP=-64.*AN(II)**2*(1.-2.*X)
      SB=(-ALM(JJ)**2)*Y(3)-128.*(AN(II)**2)*Y(3)-2.*GP*Y(4)
      IF(KK.EQ.1) GO TO 20
   25 DY(4)=SB/G
      GO TO 70
   20 DY(4)=(-8.*AN(II)+SB)/G
   70 RETURN
      END
```

```
      SUBROUTINE INTGL(F,H,AR,N)
      IMPLICIT INTEGER*4(I-N),REAL*8(A-H,O-Z)
      DIMENSION F(N)
      AR=F(1)-F(N)
      M=N-1
      DO 10 I=2,M,2
      J=I+1
   10 AR=AR+4.*F(I)+2.*F(J)
      AR=AR*H/3.
      RETURN
      END
```

```
      SUBROUTINE TINTGC(N,TWH,TJP,PA,ANG,PAV,ANV,T)
      IMPLICIT INTEGER*4(I-N),REAL*8(A-H,C-Z)
      DIMENSION T(21)
      DIMENSION PA(3)
      DIMENSION XI(3),FA(3,21),ANV(4),PAV(4)
      DIMENSION TJP(4)
      DIMENSION DRIV(21),DX(21),IX(21),A(4,21),TIG(4,21)
      DIMENSION TWH(4,21),TA(4),AP(4),ANG(4),SYMX(4),SYMN(4)
      DIMENSION Y(5),Z(5)
   63 FORMAT(1HO,10X,'+.M.',3D16.8)
   64 FORMAT(1HO,10X,'-.M.',3D16.8)
  100 FORMAT(1HO,10X,'T.A.',4D16.8)
    1 FORMAT(1H-,24X,'INTEGRATION OF INFLUENCE LINES')
    2 FORMAT(1HO,13X,'MOMENT',6X,'HOR. REACTION',7X,'THRUST')
   69 FORMAT(1HO,4X,'-.S.',16X,1D16.8,16X,1D16.8)
   65 FORMAT(1HO,4X,'+.S.',16X,1D16.8,16X,1D16.8)
      NN=N+1
      DO 10 I=1,3
      Y(I)=0.
   10 Z(I)=0.
      DO 15 J=2,20,2
      J1=J-1
      J2=J+1
      IF (J.EQ.2)GO TO 16
      B=TWH(1,J1)*TWH(1,J)
      IF(B.GT.0.) GO TO 16
      GO TO 20
   16 B=TWH(1,J)*TWH(1,J2)
      IF(B.GT.0.) GO TO 17
      GO TO 21
   17 DO 22 I=1,3
      IF(N.EQ.1) GO TO 22
      IF(I.LE.2)GO TO 22
      IF(J.EQ.NN)GO TO 23
      GO TO 22
   23 TWH(I,J1)=TJP(I)
   22 Y(I)=Y(I)+(TWH(I,J1)+4.*TWH(I,J)+TWH(I,J2))/60.
   15 CONTINUE
   20 M=J1
      X=DABS(TWH(1,M))/(DABS(TWH(1,M))+DABS(TWH(1,M+1)))
      DO 30 I=1,3
      Y(I)=Y(I)+TWH(I,M)*X/40.
   30 Z(I)=Z(I)+(TWH(I,M)+4.*TWH(I,M+1)+TWH(I,M+2))/60.-TWH(I,M)*X/40.
      M=M+3
      GO TO 50
   21 M=J
      X=DABS(TWH(1,M))/(DABS(TWH(1,M))+DABS(TWH(1,M+1)))
      DO 40 I=1,3
      Z(I)=Z(I)+(1.-X)*TWH(I,M+1)/40.
   40 Y(I)=Y(I)+(TWH(I,M-1)+4.*TWH(I,M)+TWH(I,M+1))/60.-Z(I)
      M=M+2
   50 DO 159 J=M,20,2
```

```
      J1=J-1
      J2=J+1
      IF(J.EC.2C) GC TC 179
      B=TWH(1,J1)*TWH(1,J)
      IF(B.GT.C.) GC TO 169
      GO TC 200
  169 B=TWH(1,J)*TWH(1,J2)
      IF(B.GT.C.) GC TO 179
      GO TC 219
  179 DO 229 I=1,3
      IF(N.EC.1) GO TO 229
      IF(I.LE.2)GO TO 229
      IF(J.EC.NN)GC TO 239
      GO TC 229
  239 TWH(I,J1)=TJP(I)
  229 Z(I)=Z(I)+(TWH(I,J1)+4.*TWH(I,J)+TWH(I,J2))/60.
  159 CONTINUE
      GO TO 599
  200 M=J1
      X=DABS(TWH(1,M))/(DABS(TWH(1,M))+DABS(TWH(1,M+1)))
      DO 3C9 I=1,3
      Z(I)=Z(I)+TWH(I,M)*X/40.
  309 Y(I)=Y(I)+(TWH(I,M)+4.*TWH(I,M+1)+TWH(I,M+2))/60.-TWH(I,M)*X/40.
      M=M+3
      GO TC 509
  219 M=J
      X=DABS(TWH(1,M))/(DABS(TWH(1,M))+DABS(TWH(1,M+1)))
      DO 4C9 I=1,3
      Y(I)=Y(I)+(1.-X)*TWH(I,M+1)/40.
  409 Z(I)=Z(I)+(TWH(I,M-1)+4.*TWH(I,M)+TWH(I,M+1))/60.-(1.-X)*TWH(I,M+
     1)/4C.
      M=M+2
  509 DO 459 J=M,20,2
      J1=J-1
      J2=J+1
      DO 459 I=1,3
  459 Y(I)=Y(I)+(TWH(I,J1)+4.*TWH(I,J)+TWH(I,J2))/60.
  599 IF(Y(1).GT.C.) GO TC 659
      DO 759 I=1,3
      ANG(I)=Y(I)
      T(I)=Y(I)+Z(I)
  759 PA(I)=Z(I)
      GO TO 99
  659 DO 769 I=1,3
      PA(I)=Y(I)
      ANG(I)=Z(I)
  769 T(I)=Y(I)+Z(I)
   99 WRITE(3,1)
      WRITE(3,2)
      WRITE(3,100)(T(I),I=1,3)
      WRITE(3,63)(PA(I),I=1,3)
      WRITE(3,64)(ANG(I),I=1,3)
      RETURN
      END
```

Appendix 2

INFLUENCE LINE TABULATION

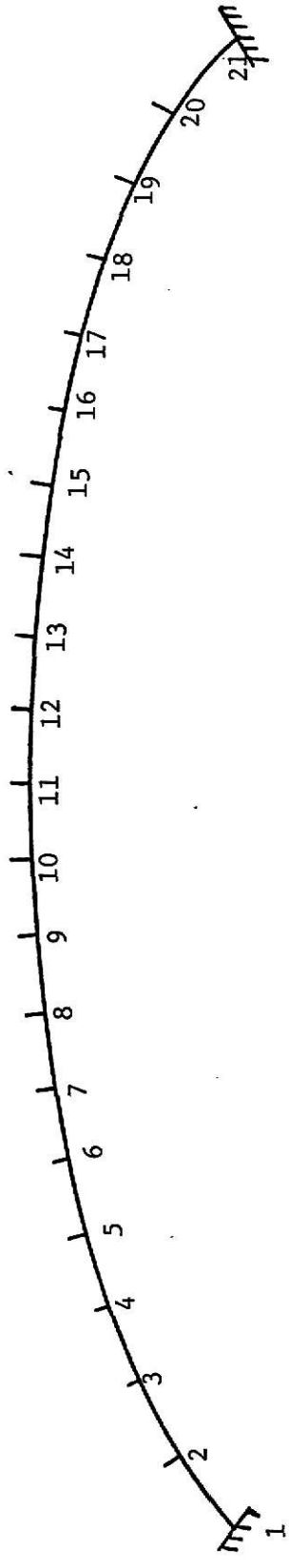

Figure 9. Position of Sections

LAMDA= 0.000000

INFLUENCE LINES FOR SECTION 1

MOMENT	THRUST	SHEAR
0.00000000D 00	0.62469505D 00	0.78086881D 00
-0.40691682D-01	0.64993274D 00	0.75276490D 00
-0.64399656D-01	0.71700350D 00	0.67569885D 00
-0.73700275D-01	0.81265604D 00	0.56093388D 00
-0.71311142D-01	0.92349772D 00	0.42009348D 00
-0.60039382D-01	0.10363785D 01	0.26488354D 00
-0.42708187D-01	0.11388767D 01	0.10672375D 00
-0.22061970D-01	0.12198678D 01	-0.43702737D-01
-0.65450960D-03	0.12701362D 01	-0.17695429D 00
0.19270777D-01	0.12829660D 01	-0.28534311D 00
0.35895107D-01	0.12546302D 01	-0.36339180D 00
0.47918045D-01	0.11847052D 01	-0.40816900D 00
0.54615721D-01	0.10761438D 01	-0.41944476D 00
0.55857837D-01	0.93510788D 00	-0.39965258D 00
0.52080192D-01	0.77057189D 00	-0.35365728D 00
0.44220812D-01	0.59377010D 00	-0.28837702D 00
0.33631415D-01	0.41756704D 00	-0.21231988D 00
0.21977774D-01	0.25583062D 00	-0.13509790D 00
0.11141039D-01	0.12286781D 00	-0.66970753D-01
0.31286899D-02	0.32958495D-01	-0.18452909D-01
-0.00000000D 00	-0.00000000D 00	-0.00000000D 00

INTEGRATION OF INFLUENCE LINES

	MOMENT	HOR. REACTION	THRUST
T.A.	0.17077586D-05	0.62501188D 00	0.80039964D 00
+.M.	0.19060007D-01	0.42875716D 00	0.42720781D 00
-.M.	-0.19058299D-01	0.19625472D 00	0.37319183D 00

LAMDA= 0.000000

INFLUENCE LINES FOR SECTION 3

MOMENT	THRUST	SHEAR
0.00000000D 00	0.00000000D 00	0.00000000D 00
0.60074102D-02	0.28054982D-01	-0.25292095D-01
0.23234356D-01	0.10286320D 00	-0.94872241D-01
0.40770849D-03	0.74911535D 00	0.64333712D 00
-0.13843271D-01	0.87416261D 00	0.51494283D 00
-0.20967274D-01	0.10027498D 01	0.37247337D 00
-0.22459723D-01	0.11213224D 01	0.22597786D 00
-0.19819803D-01	0.12176936D 01	0.84909469D-01
-0.14496029D-01	0.12817053D 01	-0.42312363D-01
-0.78303699D-02	0.13058699D 01	-0.14874926D 00
-0.98811767D-03	0.12859048D 01	-0.22934644D 00
0.50874955D-02	0.12210800D 01	-0.28123339D 00
0.97193418D-02	0.11143080D 01	-0.30387071D 00
0.12516139D-01	0.97197234D 00	-0.29902997D 00
0.13371063D-01	0.80350970D 00	-0.27060456D 00
0.12440930D-01	0.62081996D 00	-0.22429203D 00
0.10110778D-01	0.43759154D 00	-0.16719944D 00
0.69501051D-02	0.26862687D 00	-0.10742613D 00
0.36668285D-02	0.12923312D 00	-0.53669239D-01
0.10636717D-02	0.34717347D-01	-0.14882152D-01
-0.00000000D 00	-0.00000000D 00	-0.00000000D 00
	(SPECIAL JUMP POINT)	
	0.65177068D 00	0.76279569D 00

INTEGRATION OF INFLUENCE LINES

	MOMENT	HOR. REACTION	THRUST
T.A.	0.87846041D-06	0.62501188D 00	0.73306670D 00
+.M.	0.50613181D-02	0.33012639D 00	0.35541988D 00
-.M.	-0.50604396D-02	0.29488549D 00	0.37764682D 00

LAMDA= 0.000000

INFLUENCE LINES FOR SECTION 5

MOMENT	THRUST	SHEAR
0.000000000D 00	0.000000000D 00	0.000000000D 00
0.33026755D-02	0.30919960D-01	-0.21696286D-01
0.13072737D-01	0.11362749D 00	-0.81672410D-01
0.29062331D-01	0.23267464D 00	-0.17193978D 00
0.50963894D-01	0.37239458D 00	-0.28419061D 00
0.28405886D-01	0.95006929D 00	0.49154061D 00
0.10951155D-01	0.10855617D 01	0.36053586D 00
-0.18997870D-02	0.11983576D 01	0.23222073D 00
-0.10701578D-01	0.12773517D 01	0.11371819D 00
-0.16050093D-01	0.13142685D 01	0.11005502D-01
-0.18563839D-01	0.13042432D 01	-0.71420272D-01
-0.18861641D-01	0.12462025D 01	-0.13079857D 00
-0.17539286D-01	0.11429717D 01	-0.16624018D 00
-0.15147739D-01	0.10011023D 01	-0.17872797D 00
-0.12175690D-01	0.83043404D 00	-0.17097999D 00
-0.90380226D-02	0.64347097D 00	-0.14720588D 00
-0.60706123D-02	0.45466351D 00	-0.11279701D 00
-0.35308951D-02	0.27968845D 00	-0.73994335D-01
-0.16028901D-02	0.13479622D 00	-0.37570886D-01
-0.40512377D-03	0.36268243D-01	-0.10554030D-01
-0.000000000D 00	-0.000000000D 00	-0.000000000D 00
	(SPECIAL JUMP POINT)	
	0.83567576D 00	0.68097848D 00

INTEGRATION OF INFLUENCE LINES

	MOMENT	HOR. REACTION	THRUST
T.A.	0.29718300D-06	0.62501188D 00	0.69379099D 00
+.M.	0.66017667D-02	0.11546808D 00	0.14605272D 00
-.M.	-0.66014695D-02	0.50954380D 00	0.54773827D 00

LAMDA= 0.000000

INFLUENCE LINES FOR SECTION 7

MOMENT	THRUST	SHEAR
0.00000000D 00	0.00000000D 00	0.00000000D 00
0.11941665D-02	0.33607447D-01	-0.17242762D-01
0.51156217D-02	0.12377035D 00	-0.65287793D-01
0.12263559D-01	0.25408977D 00	-0.13834450D 00
0.23110190D-01	0.40790608D 00	-0.23033618D 00
0.38079766D-01	0.56875690D 00	-0.33502259D 00
0.57524336D-01	0.72096225D 00	-0.44617088D 00
0.31698004D-01	0.11550925D 01	0.39465072D 00
0.10731502D-01	0.12496176D 01	0.28812399D 00
-0.53884034D-02	0.13002952D 01	0.19145678D 00
-0.16832045D-01	0.13016887D 01	0.10843521D 00
-0.23929336D-01	0.12523558D 01	0.41646179D-01
-0.27160130D-01	0.11549727D 01	-0.76413723D-02
-0.27133755D-01	0.10161640D 01	-0.39500935D-01
-0.24560024D-01	0.84604958D 00	-0.55273000D-01
-0.20216009D-01	0.65759310D 00	-0.57409481D-01
-0.14912727D-01	0.46584873D 00	-0.49265414D-01
-0.94652082D-02	0.28720197D 00	-0.34868890D-01
-0.46681076D-02	0.13867966D 00	-0.18696225D-01
-0.12776940D-02	0.37374285D-01	-0.54713964D-02
-0.00000000D 00	-0.00000000D 00	-0.00000000D 00
	(SPECIAL JUMP POINT)	
	0.10717256D 01	0.64996441D 00

INTEGRATION OF INFLUENCE LINES

	MOMENT	HOR. REACTION	THRUST
T.A.	-0.40168395D-07	0.62501188D 00	0.65699797D 00
+.M.	0.87648367D-02	0.21369619D 00	0.22332844D 00
-.M.	-0.87648769D-02	0.41131569D 00	0.43366953D 00

LAMDA= 0.000000

INFLUENCE LINES FOR SECTION 9

MOMENT	THRUST	SHEAR
0.00000000D 00	0.00000000D 00	0.00000000D 00
-0.31811581D-03	0.35819378D-01	-0.11989399D-01
-0.63698679D-03	0.13218521D 00	-0.45920243D-01
0.11489768D-04	0.27201393D 00	-0.98535483D-01
0.25957897D-02	0.43792124D 00	-0.16633444D 00
0.80547029D-02	0.61269318D 00	-0.24562509D 00
0.17260026D-01	0.77989043D 00	-0.33260496D 00
0.30973607D-01	0.92456547D 00	-0.42347200D 00
0.49802049D-01	0.10340438D 01	-0.51456199D 00
0.24154456D-01	0.12566808D 01	0.38493767D 00
0.42070451D-02	0.12705510D 01	0.30307100D 00
-0.10115781D-01	0.12318298D 01	0.22961906D 00
-0.19143349D-01	0.11429720D 01	0.16623904D 00
-0.23442043D-01	0.10105378D 01	0.11385510D 00
-0.23782046D-01	0.84473360D 00	0.72664802D-01
-0.21093107D-01	0.65874438D 00	0.42194837D-01
-0.16415619D-01	0.46795773D 00	0.21393630D-01
-0.10852865D-01	0.28917874D 00	0.87445444D-02
-0.55288385D-02	0.13991394D 00	0.23843253D-02
-0.15540428D-02	0.37772043D-01	0.21475683D-03
0.00000000D 00	0.00000000D 00	0.00000000D 00
	(SPECIAL JUMP POINT)	
	0.12314802D 01	0.71941519D 00

INTEGRATION OF INFLUENCE LINES

	MOMENT	HOR. REACTION	THRUST
T.A.	-0.17763495D-06	0.62501188D 00	0.63361860D 00
+.M.	0.66409161D-02	0.31320307D 00	0.31221218D 00
-.M.	-0.66410937D-02	0.31180881D 00	0.32140642D 00

LAMDA= 0.000000

INFLUENCE LINES FOR SECTION 11

MOMENT	THRUST	SHEAR
0.00000000D 00	0.00000000D 00	0.00000000D 00
-0.12341809D-02	0.37263719D-01	-0.61796924D-02
-0.41851229D-02	0.13778001D 00	-0.24459487D-01
-0.76939489D-02	0.28416527D 00	-0.54322282D-01
-0.10579421D-01	0.45870047D 00	-0.95057930D-01
-0.11669503D-01	0.64380455D 00	-0.14574042D 00
-0.98419901D-02	0.82264389D 00	-0.20521228D 00
-0.40728822D-02	0.97985803D 00	-0.27208080D 00
0.65107483D-02	0.11023528D 01	-0.34473022D 00
0.22578699D-01	0.11800811D 01	-0.42135296D 00
0.44553110D-01	0.12067113D 01	-0.50000001D 00
0.22578700D-01	0.11800811D 01	0.42135296D 00
0.65107504D-02	0.11023528D 01	0.34473023D 00
-0.40728799D-02	0.97985806D 00	0.27208081D 00
-0.98419880D-02	0.82264391D 00	0.20521229D 00
-0.11669501D-01	0.64380457D 00	0.14574043D 00
-0.10579419D-01	0.45870048D 00	0.95057940D-01
-0.76939482D-02	0.28416528D 00	0.54322289D-01
-0.41851226D-02	0.13778001D 00	0.24459490D-01
-0.12341809D-02	0.37263720D-01	0.61796934D-02
0.00000000D 00	0.00000000D 00	0.00000000D 00
	(SPECIAL JUMP POINT)	
	0.12067113D 01	0.85425977D 00

INTEGRATION OF INFLUENCE LINES

	MOMENT	HOR. REACTION	THRUST
T.A.	-0.19023631D-06	0.62501188D 00	0.62501188D 00
+.M.	0.49128833D-02	0.26821976D 00	0.26821976D 00
-.M.	-0.49130736D-02	0.35679212D 00	0.35679212D 00

LAMDA= 0.629319

INFLUENCE LINES FOR SECTION 1

MOMENT	THRUST	SHEAR
0.00000000D 00	0.62469505D 00	0.78086881D 00
-0.40716601D-01	0.64989495D 00	0.75283407D 00
-0.64478194D-01	0.71690521D 00	0.67590776D 00
-0.73834902D-01	0.81253120D 00	0.56127281D 00
-0.71485734D-01	0.92340742D 00	0.42050157D 00
-0.60227069D-01	0.10363844D 01	0.26527697D 00
-0.42878860D-01	0.11390198D 01	0.10702093D 00
-0.22188820D-01	0.12201551D 01	-0.43561473D-01
-0.71897054D-03	0.12705367D 01	-0.17699448D 00
0.19276197D-01	0.12834160D 01	-0.28555260D 00
0.35966322D-01	0.12550477D 01	-0.36372584D 00
0.48041098D-01	0.11850083D 01	-0.40856218D 00
0.54770132D-01	0.10762709D 01	-0.41982672D 00
0.56020862D-01	0.93503305D 00	-0.39996397D 00
0.52231047D-01	0.77031330D 00	-0.35386217D 00
0.44344093D-01	0.59338750D 00	-0.28846917D 00
0.33719150D-01	0.41714904D 00	-0.21232141D 00
0.22029890D-01	0.25547251D 00	-0.13505054D 00
0.11164272D-01	0.12264240D 00	-0.66920742D-01
0.31341966D-02	0.32882705D-01	-0.18431230D-01
-0.00000000D 00	-0.00000000D 00	-0.00000000D 00

INTEGRATION OF INFLUENCE LINES

	MOMENT	HOR. REACTION	THRUST
T.A.	0.15684432D-05	0.62501114D 00	0.80039904D 00
+.M.	0.19106783D-01	0.42871749D 00	0.42709427D 00
-.M.	-0.19105215D-01	0.19629365D 00	0.37330477D 00

LAMDA= 0.628319

INFLUENCE LINES FOR SECTION 3

MOMENT	THRUST	SHEAR
0.00000000D 00	0.00000000D 00	0.00000000D 00
0.60061661D-02	0.28125151D-01	-0.25132643D-01
0.23224910D-01	0.10322130D 00	-0.94242996D-01
0.37597483D-03	0.74987857D 00	0.64445377D 00
-0.13931717D-01	0.87529830D 00	0.51627229D 00
-0.21046001D-01	0.10042317D 01	0.37376378D 00
-0.22545947D-01	0.11231086D 01	0.22702377D 00
-0.19898638D-01	0.12197126D 01	0.85569376D-01
-0.14555023D-01	0.12838528D 01	-0.42106755D-01
-0.78585689D-02	0.13080151D 01	-0.14899333D 00
-0.98291898D-03	0.12879067D 01	-0.22997252D 00
0.51237686D-02	0.12226085D 01	-0.28212867D 00
0.97794856D-02	0.11156652D 01	-0.30489982D 00
0.12589847D-01	0.97291065D 00	-0.30005866D 00
0.13447079D-01	0.80404033D 00	-0.27152043D 00
0.12509153D-01	0.62101057D 00	-0.22501928D 00
0.10163952D-01	0.43755226D 00	-0.16770589D 00
0.69848845D-02	0.26848594D 00	-0.10772220D 00
0.36841299D-02	0.12910492D 00	-0.53799839D-01
0.10683577D-02	0.34665747D-01	-0.14912961D-01
-0.00000000D 00	-0.00000000D 00	-0.00000000D 00
	(SPECIAL JUMP POINT)	
	0.65175320D 00	0.76283808D 00

INTEGRATION OF INFLUENCE LINES

	MOMENT	HOR. REACTION	THRUST
T.A.	0.79463673D-06	0.62501114D 00	0.73398131D 00
+.M.	0.50814643D-02	0.33011854D 00	0.35574320D 00
-.M.	-0.50806697D-02	0.29489260D 00	0.37823812D 00

LAMDA= 0.628319

INFLUENCE LINES FOR SECTION 5

MOMENT	THRUST	SHEAR
0.000CC000D 00	0.00000000D 00	0.CCCC0000D 00
0.331238180-02	0.30919895D-01	-0.21660195D-01
0.13107568D-01	0.113708180 00	-0.81512998D-01
0.29127738D-01	0.233C1311D 00	-0.17152626D 00
0.51049486D-01	0.373230790 00	-0.28332125D 00
0.28485745D-01	0.951498520 00	0.49279428D 00
0.110C6470D-01	0.108749590 01	0.36182050D 00
-0.187702750-02	0.12C06805D 01	0.23327165D 00
-0.10710904D-01	0.127991450 01	0.114368020 00
-0.16C85391D-01	0.131689760 01	0.11183474D-01
-0.18616011D-01	0.13067567D 01	-0.71698662D-01
-0.18920930D-01	0.124843340 01	-0.13145C26D 00
-0.17597076D-01	0.114479130 01	-0.16713876D 00
-0.15197693D-01	0.1C024396D 01	-0.179730090 00
-0.12214261D-01	0.831286000 00	-0.17195C04D 00
-0.90643582D-02	0.643900040 00	-0.14803587D 00
-0.60860461D-02	0.454783530 00	-0.113419720 00
-0.35381634D-02	0.279638980 00	-0.74389040D-01
-0.16052401D-02	0.134708600 00	-0.37762139D-01
-0.40543430D-03	0.362265420-01	-0.10604682D-01
-0.000CC000D 00	-0.00C000C0D 00	-0.C0CC0000D 00
	(SPECIAL JUMP POINT)	
	0.83580997D 00	0.68038533D 00

INTEGRATION OF INFLUENCE LINES

	MOMENT	HOR. REACTION	THRUST
T.A.	0.25732231D-06	0.625011140 00	0.69484205D 00
+.M.	0.66188067D-02	0.115449980 00	0.14632105D 00
-.M.	-0.66185494D-02	0.509561160 00	0.548521000 00

LAMDA= 0.628319

INFLUENCE LINES FOR SECTION 7

MOMENT	THRUST	SHEAR
0.0CCCC000D 00	0.000000C0D 00	0.000000000D 00
0.12030443D-02	0.335586660-01	-0.172866240-01
0.51494164D-02	0.123658480 00	-0.654383850-01
0.12333896D-01	0.253998040 00	-0.138609090 00
0.23221197D-01	0.407979280 00	-0.230642310 00
0.38224131D-01	0.569168340 00	-0.335195680 00
0.57678563D-01	0.721886600 00	-0.445915810 00
0.31824656D-01	0.115654900 01	0.395329000 00
0.10805132D-01	0.125145500 01	0.288901760 00
-0.53766492D-02	0.130233270 01	0.192113820 00
-0.16877993D-01	0.130373330 01	0.108849200 00
-0.24019900D-01	0.125422560 01	0.417793170-01
-0.27277522D-01	0.115652260 01	-0.776176880-02
-0.27259346D-01	0.101730600 01	-0.398052160-01
-0.24677464D-01	0.846764550 00	-0.556722420-01
-0.20313369D-01	0.657929820 00	-0.578160620-01
-0.14983592D-01	0.465900990 00	-0.496091310-01
-0.95087960D-02	0.287118520 00	-0.351076200-01
-0.46885898D-02	0.138576030 00	-0.188210490-01
-0.12829460D-02	0.373282190-01	-0.550677320-02
-0.000C0000D 00	-0.000000000 00	-0.000000000 00
	(SPECIAL JUMP POINT)	
	0.107221490 01	0.648859880 00

INTEGRATION OF INFLUENCE LINES

	MOMENT	HOR. REACTION	THRUST
T.A.	-0.46991696D-07	0.625011140 00	0.657689320 00
+.M.	0.88011472D-02	0.213710010 00	0.223589790 00
-.M.	-0.88011942D-02	0.411301120 00	0.434099530 00

LAMDA= 0.628319

INFLUENCE LINES FOR SECTION 9

MOMENT	THRUST	SHEAR
0.00000000D 00	0.00000000D 00	0.00000000D 00
-0.31560346D-03	0.35747201D-01	-0.12060534D-01
-0.62621002D-03	0.13198061D 00	-0.46184333D-01
0.37212273D-04	0.27171343D 00	-0.99069695D-01
0.26432256D-02	0.43761923D 00	-0.16715223D 00
0.81288919D-02	0.61250616D 00	-0.24665755D 00
0.17361343D-01	0.77992721D 00	-0.33368406D 00
0.31093663D-01	0.92490671D 00	-0.42431762D 00
0.49918545D-01	0.10347330D 01	-0.51477443D 00
0.24233465D-01	0.12576511D 01	0.38539943D 00
0.42297907D-02	0.12716379D 01	0.30387215D 00
-0.10149968D-01	0.12328699D 01	0.23051719D 00
-0.19222715D-01	0.11438291D 01	0.16707590D 00
-0.23548165D-01	0.10111245D 01	0.11454366D 00
-0.23894990D-01	0.84502443D 00	0.73173502D-01
-0.21195527D-01	0.65877635D 00	0.42531056D-01
-0.16495501D-01	0.46781770D 00	0.21588140D-01
-0.10904906D-01	0.28897869D 00	0.88381882D-02
-0.55545690D-02	0.13975693D 00	0.24176618D-02
-0.15609628D-02	0.37712219D-01	0.22082535D-03
0.00000000D 00	0.00000000D 00	0.00000000D 00
	(SPECIAL JUMP POINT)	
	0.12322262D 01	0.71955734D 00

INTEGRATION OF INFLUENCE LINES

	MOMENT	HOR. REACTION	THRUST
T.A.	-0.16271577D-06	0.62501114D 00	0.63383485D 00
+.M.	0.66695941D-02	0.31336464D 00	0.31244984D 00
-.M.	-0.66697568D-02	0.31164650D 00	0.32138501D 00

LAMDA= 0.628319

INFLUENCE LINES FOR SECTION 11

MOMENT	THRUST	SHEAR
0.000CC000D 00	0.00C000000D 00	0.000C00000D 00
-0.123813850-02	0.37190994D-01	-0.62309258D-02
-0.41988322D-02	0.13757275D 00	-0.24658136D-01
-0.77190592D-02	0.28385606D 00	-0.54746873D-01
-0.10612695D-01	0.45837502D 00	-0.95757095D-01
-0.117C3001D-01	0.64356335D 00	-0.14671933D 00
-0.98644436D-02	0.82256996D 00	-0.20641847D 00
-0.40724428D-02	0.97999412D 00	-0.27339033D 00
0.65423494D-02	0.11026905D 01	-0.34593558D 00
0.22640760D-01	0.11805634D 01	-0.42215412D 00
0.44629758D-01	0.12072459D 01	-0.50000001D 00
0.22640761D-01	0.11805634D 01	0.42215412D 00
0.65423515D-02	0.11026906D 01	0.34593559D 00
-0.40724405D-02	0.97999414D 00	0.27339034D 00
-0.98644415D-02	0.82256998D 00	0.20641849D 00
-0.11702999D-01	0.64356336D 00	0.14671934D 00
-0.10612693D-01	0.45837503D 00	0.95757106D-01
-0.77190585D-02	0.28385606D 00	0.54746880D-01
-0.41988319D-02	0.13757275D 00	0.24658139D-01
-0.12381384D-02	0.37190995D-01	0.62309267D-02
0.000C0000D 00	0.000000000 00	0.000C0000D 00
	(SPECIAL JUMP POINT)	
	0.12072459D 01	0.85738743D 00

INTEGRATION OF INFLUENCE LINES

	MOMENT	HOR. REACTION	THRUST
T.A.	-0.16642896D-06	0.625011140 00	0.625011140 00
+.M.	0.49261215D-02	0.268388100 00	0.268388100 00
-.M.	-0.49262880D-02	0.35662304D 00	0.35662304D 00

LAMDA= 1.256637

INFLUENCE LINES FOR SECTION 1

MOMENT	THRUST	SHEAR
0.00000000D 00	0.62469505D 00	0.78086881D 00
-0.40792047D-01	0.64978108D 00	0.75304326D 00
-0.64716307D-01	0.71660901D 00	0.67654035D 00
-0.74243603D-01	0.81215520D 00	0.56230046D 00
-0.72016462D-01	0.92313632D 00	0.42174059D 00
-0.60798385D-01	0.10364048D 01	0.26647344D 00
-0.43399176D-01	0.11394560D 01	0.10792687D 00
-0.22576329D-01	0.12210283D 01	-0.43128042D-01
-0.91678821D-03	0.12717525D 01	-0.17711209D 00
0.19291260D-01	0.12847813D 01	-0.28618527D 00
0.36182118D-01	0.12563127D 01	-0.36473816D 00
0.48415273D-01	0.11859250D 01	-0.40975561D 00
0.55240302D-01	0.10766523D 01	-0.42098741D 00
0.56517633D-01	0.93480167D 00	-0.40091137D 00
0.52690958D-01	0.76952502D 00	-0.35448687D 00
0.44720069D-01	0.59222453D 00	-0.28875191D 00
0.33986806D-01	0.41588060D 00	-0.21232905D 00
0.22188942D-01	0.25438731D 00	-0.13490941D 00
0.11235221D-01	0.12196017D 00	-0.66770704D-01
0.31510302D-02	0.32653598D-01	-0.18366092D-01
-0.00000000D 00	-0.00000000D 00	-0.00000000D 00

INTEGRATION OF INFLUENCE LINES

	MOMENT	HOR. REACTION	THRUST
T.A.	0.11453437D-05	0.62500894D 00	0.80039726D 00
+.M.	0.19249221D-01	0.42859729D 00	0.42674939D 00
-.M.	-0.19248075D-01	0.19641165D 00	0.37364787D 00

LAMDA= 1.256637

INFLUENCE LINES FOR SECTION 3

MOMENT	THRUST	SHEAR
0.00000000D 00	0.00000000D 00	0.00000000D 00
0.60022114D-02	0.28340319D-01	-0.24649229D-01
0.23195701D-01	0.10431435D 00	-0.92337035D-01
0.27893195D-03	0.75220901D 00	0.64783813D 00
-0.14079969D-01	0.87877345D 00	0.52030833D 00
-0.21285966D-01	0.10087748D 01	0.37763887D 00
-0.22808790D-01	0.11285922D 01	0.23021254D 00
-0.20139052D-01	0.12259174D 01	0.87588592D-01
-0.14732283D-01	0.12904574D 01	-0.41468394D-01
-0.79446878D-02	0.13146175D 01	-0.14972491D 00
-0.96713515D-03	0.12940728D 01	-0.23187019D 00
0.52344229D-02	0.12281376D 01	-0.28484975D 00
0.99630435D-02	0.11198568D 01	-0.30803179D 00
0.12814834D-01	0.97581798D 00	-0.30319175D 00
0.13679111D-01	0.80569697D 00	-0.27431123D 00
0.12717371D-01	0.62162291D 00	-0.22723598D 00
0.10326205D-01	0.43745622D 00	-0.16924985D 00
0.70909759D-02	0.26807263D 00	-0.10862494D 00
0.37368876D-02	0.12872324D 00	-0.54198151D-01
0.10826415D-02	0.34511365D-01	-0.15006970D-01
-0.00000000D 00	-0.00000000D 00	-0.00000000D 00
	(SPECIAL JUMP POINT)	
	0.65170048D 00	0.76295378D 00

INTEGRATION OF INFLUENCE LINES

	MOMENT	HOR. REACTION	THRUST
T.A.	0.53787933D-06	0.62500894D 00	0.73679956D 00
+.M.	0.51429378D-02	0.33009295D 00	0.35674197D 00
-.M.	-0.51423999D-02	0.29491600D 00	0.38005759D 00

LAMDA= 1.256637

INFLUENCE LINES FOR SECTION 5

MOMENT	THRUST	SHEAR
0.00000000D 00	0.00000000D 00	0.00000000D 00
0.33418011D-02	0.30924316D-01	-0.21548543D-01
0.13213131D-01	0.11396951D 00	-0.81021781D-01
0.29325975D-01	0.23407286D 00	-0.17025845D 00
0.51309017D-01	0.37581803D 00	-0.28067010D 00
0.28728529D-01	0.95590449D 00	0.49661069D 00
0.11174985D-01	0.10934564D 01	0.36573360D 00
-0.18070941D-02	0.12078411D 01	0.23647701D 00
-0.10738411D-01	0.12878191D 01	0.11635418D 00
-0.16191996D-01	0.13250118D 01	0.11731967D-01
-0.18774192D-01	0.13145202D 01	-0.72543118D-01
-0.19100147D-01	0.12553312D 01	-0.13343587D 00
-0.17772865D-01	0.11504266D 01	-0.16988026D 00
-0.15349807D-01	0.10065931D 01	-0.18278956D 00
-0.12331808D-01	0.83394616D 00	-0.17491265D 00
-0.91446818D-02	0.64525722D 00	-0.15057110D 00
-0.61331630D-02	0.45518524D 00	-0.11532177D 00
-0.35603844D-02	0.27951157D 00	-0.75594483D-01
-0.16124462D-02	0.13445384D 00	-0.38346094D-01
-0.40639583D-03	0.36103157D-01	-0.10759292D-01
-0.00000000D 00	-0.00000000D 00	-0.00000000D 00
	(SPECIAL JUMP POINT)	
	0.83622236D 00	0.67850555D 00

INTEGRATION OF INFLUENCE LINES

	MOMENT	HOR. REACTION	THRUST
T.A.	0.13496066D-06	0.62500894D 00	0.69809663D 00
+.M.	0.66705610D-02	0.11539539D 00	0.14714858D 00
-.M.	-0.66704260D-02	0.50961355D 00	0.55094805D 00

LAMDA= 1.256637

INFLUENCE LINES FOR SECTION 7

MOMENT	THRUST	SHEAR
0.00000000D 00	0.00000000D 00	0.00000000D 00
0.12301355D-02	0.33414145D-01	-0.17418797D-01
0.52525177D-02	0.12333123D 00	-0.65891779D-01
0.12548393D-01	0.25374413D 00	-0.13940450D 00
0.23559540D-01	0.40824045D 00	-0.23155965D 00
0.38663929D-01	0.57047140D 00	-0.33570756D 00
0.58148353D-01	0.72476000D 00	-0.44513410D 00
0.32210868D-01	0.11610499D 01	0.39738846D 00
0.11030265D-01	0.12571242D 01	0.29126249D 00
-0.53398918D-02	0.13086179D 01	0.19410853D 00
-0.17017259D-01	0.13100426D 01	0.11010556D 00
-0.24295545D-01	0.12600012D 01	0.42181166D-01
-0.27635389D-01	0.11613178D 01	-0.81321906D-02
-0.27642560D-01	0.10208500D 01	-0.40736152D-01
-0.25036021D-01	0.84899728D 00	-0.56892620D-01
-0.20610734D-01	0.65899912D 00	-0.59058446D-01
-0.15200085D-01	0.46612861D 00	-0.50659160D-01
-0.96419725D-02	0.28688582D 00	-0.35836727D-01
-0.47511733D-02	0.13827191D 00	-0.19202148D-01
-0.12989939D-02	0.37191443D-01	-0.56147417D-02
-0.00000000D 00	-0.00000000D 00	-0.00000000D 00
	(SPECIAL JUMP POINT)	
	0.10737133D 01	0.64534483D 00

INTEGRATION OF INFLUENCE LINES

	MOMENT	HOR. REACTION	THRUST
T.A.	-0.66592958D-07	0.62500894D 00	0.65983803D 00
+.M.	0.89118788D-02	0.21375198D 00	0.22440068D 00
-.M.	-0.89119454D-02	0.41125697D 00	0.43543736D 00

LAMDA= 1.256637

INFLUENCE LINES FOR SECTION 9

MOMENT	THRUST	SHEAR
0.00000000D 00	0.00000000D 00	0.00000000D 00
-0.30783827D-03	0.35529857D-01	-0.12277418D-01
-0.59297708D-03	0.13136465D 00	-0.46989405D-01
0.11633755D-03	0.27080987D 00	-0.10069774D 00
0.27887813D-02	0.43671471D 00	-0.16964335D 00
0.83559921D-02	0.61195458D 00	-0.24980065D 00
0.17670787D-01	0.78005941D 00	-0.33696708D 00
0.31459586D-01	0.92596760D 00	-0.42689010D 00
0.50273066D-01	0.10368534D 01	-0.51542846D 00
0.24473766D-01	0.12606272D 01	0.38679008D 00
0.42988302D-02	0.12749697D 01	0.30629949D 00
-0.10254357D-01	0.12366603D 01	0.23324710D 00
-0.19464862D-01	0.11464622D 01	0.16962615D 00
-0.23871978D-01	0.10129335D 01	0.11664688D 00
-0.24239683D-01	0.84593109D 00	0.74730849D-01
-0.21508138D-01	0.65889274D 00	0.43562812D-01
-0.16739335D-01	0.46740751D 00	0.22186637D-01
-0.11063751D-01	0.28838188D 00	0.91273013D-02
-0.56330992D-02	0.13928633D 00	0.25210820D-02
-0.15820801D-02	0.37532613D-01	0.23980464D-03
0.00000000D 00	0.00000000D 00	0.00000000D 00
	(SPECIAL JUMP POINT)	
	0.12345053D 01	0.71989518D 00

INTEGRATION OF INFLUENCE LINES

	MOMENT	HOR. REACTION	THRUST
T.A.	-0.11369808D-06	0.62500894D 00	0.63450850D 00
+.M.	0.67573694D-02	0.31382224D 00	0.31314775D 00
-.M.	-0.67574831D-02	0.31118670D 00	0.32136076D 00

LAMDA= 1.256637

INFLUENCE LINES FOR SECTION 11

MOMENT	THRUST	SHEAR
0.00000000D 00	0.00000000D 00	0.00000000D 00
-0.12501516D-02	0.36971400D-01	-0.63879542D-02
-0.42404417D-02	0.13694628D 00	-0.25266845D-01
-0.77952579D-02	0.28292048D 00	-0.56047365D-01
-0.10713632D-01	0.45738931D 00	-0.97897211D-01
-0.11804556D-01	0.64283184D 00	-0.14971312D 00
-0.99324217D-02	0.82234466D 00	-0.21010313D 00
-0.40709486D-02	0.98040526D 00	-0.27738497D 00
0.66382804D-02	0.11037134D 01	-0.34960613D 00
0.22828865D-01	0.11820247D 01	-0.42458887D 00
0.44861942D-01	0.12088661D 01	-0.50000001D 00
0.22828867D-01	0.11820247D 01	0.42458887D 00
0.66382826D-02	0.11037135D 01	0.34960614D 00
-0.40709462D-02	0.98040528D 00	0.27738499D 00
-0.99324195D-02	0.82234468D 00	0.21010314D 00
-0.11804554D-01	0.64283186D 00	0.14971313D 00
-0.10713631D-01	0.45738932D 00	0.97897221D-01
-0.77952571D-02	0.28292049D 00	0.56047372D-01
-0.42404414D-02	0.13694629D 00	0.25266848D-01
-0.12501515D-02	0.36971400D-01	0.63879551D-02
0.00000000D 00	0.00000000D 00	0.00000000D 00
	(SPECIAL JUMP POINT)	
	0.12088662D 01	0.86705722D 00

INTEGRATION OF INFLUENCE LINES

	MOMENT	HOR. REACTION	THRUST
T.A.	-0.88833607D-07	0.62500894D 00	0.62500894D 00
+.M.	0.49662650D-02	0.26889697D 00	0.26889697D 00
-.M.	-0.49663538D-02	0.35611197D 00	0.35611197D 00

LAMDA= 1.884956

INFLUENCE LINES FOR SECTION 1

MOMENT	THRUST	SHEAR
0.00000000D 00	0.62469505D 00	0.73086881D 00
-0.40920161D-01	0.64958968D 00	0.75339762D 00
-0.65121748D-01	0.71611097D 00	0.67761472D 00
-0.74941366D-01	0.81152369D 00	0.56405037D 00
-0.72924981D-01	0.92268418D 00	0.42385634D 00
-0.61779078D-01	0.10364488D 01	0.26852326D 00
-0.44295063D-01	0.11402076D 01	0.10948650D 00
-0.23246289D-01	0.12225232D 01	-0.42372170D-01
-0.12619161D-02	0.12738289D 01	-0.17729762D 00
0.19312113D-01	0.12871088D 01	-0.28725378D 00
0.36549124D-01	0.12584646D 01	-0.36646014D 00
0.49056167D-01	0.11874779D 01	-0.41179233D 00
0.56047868D-01	0.10772886D 01	-0.42297292D 00
0.57372210D-01	0.93439200D 00	-0.40253612D 00
0.53482908D-01	0.76816809D 00	-0.35556285D 00
0.45367958D-01	0.59023411D 00	-0.28924515D 00
0.34448338D-01	0.41371701D 00	-0.21235263D 00
0.22463421D-01	0.25254131D 00	-0.13467760D 00
0.11357805D-01	0.12080258D 00	-0.66520761D-01
0.31801761D-02	0.32265818D-01	-0.18257211D-01
-0.00000000D 00	-0.00000000D 00	-0.00000000D 00

INTEGRATION OF INFLUENCE LINES

	MOMENT	HOR. REACTION	THRUST
T.A.	0.42148434D-06	0.62500537D 00	0.80039435D 00
+.M.	0.19493908D-01	0.42839279D 00	0.42615990D 00
-.M.	-0.19493486D-01	0.19661258D 00	0.37423445D 00

LAMDA= 1.884956

INFLUENCE LINES FOR SECTION 3

MOMENT	THRUST	SHEAR
0.00000000D 00	0.00000000D 00	0.00000000D 00
0.59948489D-02	0.28715435D-01	-0.23826206D-01
0.23144007D-01	0.10620235D 00	-0.89097918D-01
0.11081721D-03	0.75623754D 00	0.65359690D 00
-0.14387143D-01	0.88480668D 00	0.52719908D 00
-0.21699006D-01	0.10166921D 01	0.38441638D 00
-0.23261305D-01	0.11381762D 01	0.23570351D 00
-0.20553274D-01	0.12367851D 01	0.91090983D-01
-0.15038027D-01	0.13020445D 01	-0.40329160D-01
-0.80935001D-02	0.13262175D 01	-0.15094108D 00
-0.94019147D-03	0.13049236D 01	-0.23509918D 00
0.54251896D-02	0.12375360D 01	-0.28950602D 00
0.10279794D-01	0.11272754D 01	-0.31340581D 00
0.13203196D-01	0.98099805D 00	-0.30857622D 00
0.14079628D-01	0.80869417D 00	-0.27911209D 00
0.13076690D-01	0.62279265D 00	-0.23105154D 00
0.10606078D-01	0.43737782D 00	-0.17190851D 00
0.72738663D-02	0.26742030D 00	-0.11018002D 00
0.38277721D-02	0.12809884D 00	-0.54884661D-01
0.11072295D-02	0.34255940D-01	-0.15169168D-01
-0.00000000D 00	-0.00000000D 00	-0.00000000D 00
	(SPECIAL JUMP POINT)	
	0.65161194D 00	0.76310455D 00

INTEGRATION OF INFLUENCE LINES

	MOMENT	HOR. REACTION	THRUST
T.A.	0.90993746D-07	0.62500537D 00	0.74176336D 00
+.M.	0.52489773D-02	0.33004331D 00	0.35851121D 00
-.M.	-0.52488863D-02	0.29496206D 00	0.38325215D 00

LAMDA= 1.884956

INFLUENCE LINES FOR SECTION 5

MOMENT	THRUST	SHEAR
0.0CCC0000D 00	0.0C0000000 00	0.000000000 00
0.33918615D-02	0.30948301D-01	-0.21350743D-01
0.13392744D-01	0.11447409D 00	-0.80158138D-01
0.29663288D-01	0.23599786D 00	-0.16805124D 00
0.51751030D-01	0.38041118D 00	-0.27610264D 00
0.29143397D-01	0.96367033D 00	0.50316275D 00
0.11464706D-01	0.11039546D 01	0.37246013D 00
-0.16847869D-02	0.12204617D 01	0.24200141D 00
-0.10782563D-01	0.13017665D 01	0.11979162D 00
-0.16372053D-01	0.13393478D 01	0.12697030D-01
-0.19043512D-01	0.13282589D 01	-0.73982204D-01
-0.19408962D-01	0.12675650D 01	-0.13685059D 00
-0.18074203D-01	0.11604549D 01	-0.17460773D 00
-0.15611103D-01	0.10140262D 01	-0.18807259D 00
-0.12534079D-01	0.83875826D 00	-0.18003214D 00
-0.92831313D-02	0.64777460D 00	-0.15495334D 00
-0.62145369D-02	0.45600791D 00	-0.11860945D 00
-0.35988782D-02	0.27937725D 00	-0.77677510D-01
-0.16250071D-02	0.13405974D 00	-0.39354716D-01
-0.40810526D-03	0.35904089D-01	-0.11026185D-01
-0.000C0000D 00	-0.000000000 00	-0.000000000 00
	(SPECIAL JUMP POINT)	
	0.83694489D 00	0.67500922D 00

INTEGRATION OF INFLUENCE LINES

	MOMENT	HOR. REACTION	THRUST
T.A.	-0.78928039D-07	0.62500537D 00	0.70388531D 00
+.M.	0.67590019D-02	0.11530343D 00	0.14860816D 00
-.M.	-0.67590809D-02	0.50970194D 00	0.55527715D 00

LAMDA= 1.884956

INFLUENCE LINES FOR SECTION 7

MOMENT	THRUST	SHEAR
0.00000000D 00	0.00000000D 00	0.00000000D 00
0.12763688D-02	0.33180133D-01	-0.17641002D-01
0.54302853D-02	0.12291689D 00	-0.66652636D-01
0.12917929D-01	0.25339918D 00	-0.14073505D 00
0.24141839D-01	0.40882714D 00	-0.23309405D 00
0.39420080D-01	0.57289190D 00	-0.33653443D 00
0.58955908D-01	0.72991026D 00	-0.44377381D 00
0.32876216D-01	0.11690240D 01	0.40090579D 00
0.11420222D-01	0.12671360D 01	0.29529122D 00
-0.52733895D-02	0.13197116D 01	0.19751393D 00
-0.17254219D-01	0.13211872D 01	0.11224864D 00
-0.24768578D-01	0.12702220D 01	0.42858879D-01
-0.28251499D-01	0.11698326D 01	-0.87818035D-02
-0.28303551D-01	0.10271820D 01	-0.42350466D-01
-0.25655234D-01	0.85303628D 00	-0.59033012D-01
-0.21124675D-01	0.66099655D 00	-0.61207422D-01
-0.15574430D-01	0.46662221D 00	-0.52474488D-01
-0.98723104D-02	0.28656351D 00	-0.37096540D-01
-0.48594279D-02	0.13779047D 00	-0.19860212D-01
-0.13267546D-02	0.36968922D-01	-0.58010361D-02
-0.00000000D 00	-0.00000000D 00	-0.00000000D 00
	(SPECIAL JUMP POINT)	
	0.10763193D 01	0.63875428D 00

INTEGRATION OF INFLUENCE LINES

	MOMENT	HOR. REACTION	THRUST
T.A.	-0.96112738D-07	0.62500537D 00	0.66368810D 00
+.M_o	0.91026609D-02	0.21382367D 00	0.22584867D 00
-.M_o	-0.91027570D-02	0.41118179D 00	0.43783944D 00

LAMDA= 1.884956

INFLUENCE LINES FOR SECTION 9

MOMENT	THRUST	SHEAR
0.00000000D 00	0.00000000D 00	0.00000000D 00
-0.29410025D-03	0.35165039D-01	-0.12650885D-01
-0.53444238D-03	0.13033146D 00	-0.48375329D-01
0.25502940D-03	0.26929875D 00	-0.10349877D 00
0.30426664D-02	0.43521529D 00	-0.17392535D 00
0.87502336D-02	0.61107206D 00	-0.25519690D 00
0.18205555D-01	0.78036033D 00	-0.34259654D 00
0.32089368D-01	0.92787005D 00	-0.43133084D 00
0.50881313D-01	0.10405760D 01	-0.51657690D 00
0.24885558D-01	0.12658188D 01	0.38912527D 00
0.44166395D-02	0.12807755D 01	0.31042660D 00
-0.10434684D-01	0.12416258D 01	0.23791906D 00
-0.19882463D-01	0.11510705D 01	0.17401345D 00
-0.24430532D-01	0.10161234D 01	0.12028219D 00
-0.24834458D-01	0.84756539D 00	0.77434980D-01
-0.22047685D-01	0.65916163D 00	0.45362866D-01
-0.17160214D-01	0.46676110D 00	0.23236448D-01
-0.11337914D-01	0.28740062D 00	0.96378579D-02
-0.57686158D-02	0.13850439D 00	0.27054590D-02
-0.16185120D-02	0.37233048D-01	0.27417241D-03
0.00000000D 00	0.00000000D 00	0.00000000D 00
	(SPECIAL JUMP POINT)	
	0.12384489D 01	0.72012824D 00

INTEGRATION OF INFLUENCE LINES

	MOMENT	HOR. REACTION	THRUST
T.A.	-0.16601399D-07	0.62500537D 00	0.63572115D 00
+.M.	0.69095819D-02	0.31450625D 00	0.31427521D 00
-.M.	-0.69095985D-02	0.31049912D 00	0.32144594D 00

LAMDA= 1.884956

INFLUENCE LINES FOR SECTION 11

MOMENT	THRUST	SHEAR
0.00000000D 00	0.00000000D 00	0.00000000D 00
-0.12706530D-02	0.36600576D-01	-0.66612335D-02
-0.43114362D-02	0.13586622D 00	-0.26325690D-01
-0.79252192D-02	0.28133419D 00	-0.58307630D-01
-0.10885669D-01	0.45571454D 00	-0.10161199D 00
-0.11977436D-01	0.64158570D 00	-0.15490058D 00
-0.10047821D-01	0.82195721D 00	-0.21647317D 00
-0.40678500D-02	0.98110030D 00	-0.28427135D 00
0.68020189D-02	0.11054507D 01	-0.35591206D 00
0.23148941D-01	0.11845096D 01	-0.42875472D 00
0.45256551D-01	0.12116221D 01	-0.50000001D 00
0.23148942D-01	0.11845096D 01	0.42875472D 00
0.68020212D-02	0.11054507D 01	0.35591207D 00
-0.40678474D-02	0.98110033D 00	0.28427136D 00
-0.10047819D-01	0.82195723D 00	0.21647319D 00
-0.11977434D-01	0.64158571D 00	0.15490059D 00
-0.10885668D-01	0.45571455D 00	0.10161200D 00
-0.79252184D-02	0.28133419D 00	0.58307638D-01
-0.43114359D-02	0.13586622D 00	0.26325694D-01
-0.12706529D-02	0.36600577D-01	0.66612345D-02
0.00000000D 00	0.00000000D 00	0.00000000D 00
	(SPECIAL JUMP POINT)	
	0.12116222D 01	0.88419989D 00

INTEGRATION OF INFLUENCE LINES

	MOMENT	HOR. REACTION	THRUST
T.A.	0.62888580D-07	0.62500537D 00	0.62500537D 00
+.M.	0.50346357D-02	0.26975818D 00	0.26975818D 00
-.M.	-0.50345728D-02	0.35524719D 00	0.35524719D 00

LAMDA= 2.513274

INFLUENCE LINES FOR SECTION 1

MOMENT	THRUST	SHEAR
0.000000000 00	0.624695056 00	0.780868816 00
-0.41104766D-01	0.649318340 00	0.753956310 00
-0.65708379D-01	0.715404570 00	0.679162990 00
-0.75955053D-01	0.810629830 00	0.566582220 00
-0.74250202D-01	0.922051790 00	0.426930570 00
-0.63215564D-01	0.103653390 01	0.271516660 00
-0.45613437D-01	0.114131490 01	0.111788930 00
-0.24238329D-01	0.122470350 01	-0.412385250-01
-0.17799457D-02	0.127614610 01	-0.177532650 00
0.19331401D-01	0.129048160 01	-0.288779420 00
0.37078953D-01	0.126157220 01	-0.368946880 00
0.49991737D-01	0.118970610 01	-0.414748790 00
0.57231858D-01	0.107817970 01	-0.425865720 00
0.58628141D-01	0.933764080 00	-0.404912770 00
0.54648610D-01	0.766172260 00	-0.357147400 00
0.46322703D-01	0.587332030 00	-0.289985710 00
0.35129171D-01	0.410578650 00	-0.212410850 00
0.22868820D-01	0.249874790 00	-0.134361580 00
0.11539194D-01	0.119136870 00	-0.661716260-01
0.32234407D-02	0.317099120-01	-0.181042310-01
-0.000000000 00	-0.000000000 00	-0.000000000 00

INTEGRATION OF INFLUENCE LINES

	MOMENT	HOR. REACTION	THRUST
T.A.	-0.63728761D-06	0.625000550 00	0.800390420 00
+.M.	0.19852762D-01	0.428097280 00	0.425301980 00
-.M.	-0.19853399D-01	0.196903270 00	0.375088450 00

LAMDA= 2.513274

INFLUENCE LINES FOR SECTION 3

MOMENT	THRUST	SHEAR
0.0000C0000 00	0.C0C0C0C0D 00	0.0C0C0C0C0D 00
0.59828091D-02	0.292790510-01	-0.226358010-01
0.230648820-01	0.108990930 00	-0.844253400-01
-0.138821330-03	0.762214460 00	0.661920180 00
-0.148397520-01	0.893817380 00	0.537209570 00
-0.223065500-01	0.102858610 01	0.394247810 00
-0.239271330-01	0.115263850 01	0.243784780 00
-0.211634770-01	0.125323930 01	0.963022630-01
-0.154891800-01	0.131963410 01	-0.385628390-01
-0.831370700-02	0.134386900 01	-0.152633070 00
-0.901092520-03	0.132147860 01	-0.239764360 00
0.570642910-02	0.125192660 01	-0.296293040 00
0.107474570-01	0.113870000 01	-0.321272480 00
0.137768700-01	0.989060050 00	-0.316477850 00
0.146712540-01	0.813468570 00	-0.286168190 00
0.136072690-01	0.624801900 00	-0.236665050 00
0.110190740-01	0.437476720 00	-0.175822700 00
0.754351060-02	0.266604120 00	-0.112470970 00
0.396162750-02	0.127258090 00	-0.558969530-01
0.114340270-02	0.339043720-01	-0.154087370-01
-0.0CCCC000D 00	-0.C0C000000 00	-0.C0C000000 00
	(SPECIAL JUMP POINT)	
	0.651487790 00	0.763211930 00

INTEGRATION OF INFLUENCE LINES

	MOMENT	HOR. REACTION	THRUST
T.A.	-0.579813100-06	0.625000550 00	0.749348060 00
+.M.	0.547630730-02	0.316339140 00	0.318979810 00
-.M.	-0.547688710-02	0.308661410 00	0.430368250 00

LAMDA= 2.513274

INFLUENCE LINES FOR SECTION 5

MOMENT	THRUST	SHEAR
0.CCCCC000D CO	0.C0000000D 00	0.C0000000D 00
0.346420580-02	0.31021689D-01	-0.21047562D-01
0.136522800-01	0.11534532D 00	-0.78848346D-01
0.301507550-01	0.23907038D 00	-0.16475044D 00
0.523907260-01	0.38750810D 00	-0.26937566D 00
0.797468680-01	0.97554297D 00	0.512762870 00
0.113900710-01	0.11199872D 01	0.382334620 00
-0.150059490-02	0.12397567D 01	0.25014335D 00
-0.108403540-01	0.132312690 01	0.12488986D 00
-0.166291640-01	0.13613494D 01	0.14163830D-01
-0.194329890-01	0.13493985D 01	-0.76066006D-01
-0.198570920-01	0.12864552D 01	-0.14186578D 00
-0.185146420-01	0.11760214D 01	-0.18157999D 00
-0.159942710-01	0.10256651D 01	-0.19588069D 00
-0.128315220-01	0.84641517D 00	-0.18760706D 00
-0.948727870-02	0.65192535D 00	-0.16144047D 00
-0.633491450-02	0.45753984D 00	-0.12347621D 00
-0.365610400-02	0.27938587D 00	-0.80759836D-01
-0.164386590-02	0.13358634D 00	-0.40846219D-01
-0.410750150-03	0.35642667D-01	-0.11420524D-01
-0.0CCCC000D 00	-0.C0000000D 00	-0.C0000000D 00
	(SPECIAL JUMP POINT)	
	0.83804107D 00	0.66923466D 00

INTEGRATION OF INFLUENCE LINES

	MOMENT	HOR. REACTION	THRUST
T.A.	-0.402012190-06	0.62500055D 00	0.71286086D 00
+.M.	0.688766420-02	0.11517278D 00	0.150841410 00
-.M.	-0.688806620-02	0.50982777D 00	0.562019450 00

LAMDA= 2.513274

INFLUENCE LINES FOR SECTION 7

MOMENT	THRUST	SHEAR
0.000C00000 00	0.C00C00C0D 00	0.CCCC0000D 00
0.13458236D-02	0.32870095D-01	-0.17955961D-01
0.56923973D-02	0.12217511D 00	-0.67728004D-01
0.13462152D-01	0.25311007D 00	-0.14260609D 00
0.24998110D-01	0.41C018580 00	-0.23520478D 00
0.40530382D-01	0.57688203D 00	-0.33763042D 00
0.60141398D-01	0.73798718D 00	-0.44173980D 00
0.33856207D-01	0.118131510 01	0.40601895D 00
0.11999296D-01	0.12824930D 01	0.30113978D 00
-0.51683057D-02	0.13367129D 01	0.20245977D 00
-0.17596550D-01	0.13382864D 01	0.11535652D 00
-0.25461111D-01	0.12859494D 01	0.43823718D-01
-0.29157968D-01	0.11830036D 01	-0.97645191D-02
-0.29278859D-01	0.10370686D 01	-0.44751477D-01
-0.26570609D-01	0.85945976D 00	-0.62138004D-01
-0.21885353D-01	0.66431869D 00	-0.64391167D-01
-0.16128906D-01	0.467632340 00	-0.55161789D-01
-0.10213627D-01	0.28627685D 00	-0.38959916D-01
-0.50198723D-02	0.13718165D 00	-0.20832579D-01
-0.13679040D-02	0.36671685D-01	-0.60759945D-02
-0.0CCCC000D 00	-0.0000C0C0D 00	-0.CCCC0000D 00
	(SPECIAL JUMP POINT)	
	0.10802222D 01	0.62774465D 00

INTEGRATION OF INFLUENCE LINES

	MOMENT	HOR. REACTION	THRUST
T.A.	-0.12979385D-06	0.625000550 00	0.66972353D 00
+.M.	0.93836955D-02	0.21392803D 00	0.22810662D 00
-.M.	-0.93838253D-02	0.411C7252D 00	0.44161692D 00

LAMDA= 2.513274

INFLUENCE LINES FOR SECTION 9

MOMENT	THRUST	SHEAR
0.00000000D 00	0.00000000D 00	0.00000000D 00
-0.27306162D-03	0.34649482D-01	-0.13200401D-01
-0.44536772D-03	0.12887386D 00	-0.50413758D-01
0.46460543D-03	0.26717904D 00	-0.10761501D 00
0.34235699D-02	0.43314578D 00	-0.18020957D 00
0.93375576D-02	0.60993526D 00	-0.26310260D 00
0.18996906D-01	0.78098251D 00	-0.35082926D 00
0.33015592D-01	0.93085795D 00	-0.43775159D 00
0.51771622D-01	0.10462360D 01	-0.51831757D 00
0.25487176D-01	0.12736329D 01	0.39242946D 00
0.45875815D-02	0.12894978D 01	0.31638258D 00
-0.10701431D-01	0.12500009D 01	0.24472965D 00
-0.20498536D-01	0.11580405D 01	0.18046041D 00
-0.25254762D-01	0.10210043D 01	0.12566268D 00
-0.25712564D-01	0.85014964D 00	0.81465233D-01
-0.22844532D-01	0.65972211D 00	0.48065116D-01
-0.17781681D-01	0.46595137D 00	0.24825267D-01
-0.11742834D-01	0.28606438D 00	0.10418332D-01
-0.59687081D-02	0.13741866D 00	0.29912430D-02
-0.16722834D-02	0.36814128D-01	0.32862883D-03
0.00000000D 00	0.00000000D 00	0.00000000D 00
	(SPECIAL JUMP POINT)	
	0.12443061D 01	0.71961996D 00

INTEGRATION OF INFLUENCE LINES

	MOMENT	HOR. REACTION	THRUST
T.A.	0.15649562D-06	0.62500055D 00	0.63763506D 00
+.M.	0.71356324D-02	0.31533077D 00	0.31582273D 00
-.M.	-0.71354759D-02	0.30966978D 00	0.32181233D 00

LAMDA= 2.513274

INFLUENCE LINES FOR SECTION 11

MOMENT	THRUST	SHEAR
0.00000000D 00	0.00000000D 00	0.00000000D 00
-0.13004055D-02	0.36070919D-01	-0.70698791D-02
-0.44144303D-02	0.13436741D 00	-0.27907906D-01
-0.81136491D-02	0.27905456D 00	-0.61680805D-01
-0.11134848D-01	0.45330026D 00	-0.10714526D 00
-0.12227373D-01	0.63978217D 00	-0.16260723D 00
-0.10213954D-01	0.82138857D 00	-0.22590458D 00
-0.40621560D-02	0.98209465D 00	-0.29442398D 00
0.70396936D-02	0.11079535D 01	-0.36516113D 00
0.23611398D-01	0.11880964D 01	-0.43482766D 00
0.45825686D-01	0.12156022D 01	-0.50000001D 00
0.23611400D-01	0.11880964D 01	0.43482766D 00
0.70396961D-02	0.11079536D 01	0.36516114D 00
-0.40621533D-02	0.98209467D 00	0.29442400D 00
-0.10213951D-01	0.82138859D 00	0.22590459D 00
-0.12227371D-01	0.63978218D 00	0.16260725D 00
-0.11134847D-01	0.45330027D 00	0.10714528D 00
-0.81136482D-02	0.27905456D 00	0.61680813D-01
-0.44144299D-02	0.13436741D 00	0.27907909D-01
-0.13004054D-02	0.36070920D-01	0.70698801D-02
0.00000000D 00	0.00000000D 00	0.00000000D 00
	(SPECIAL JUMP POINT)	
	0.12156022D 01	0.91063681D 00

INTEGRATION OF INFLUENCE LINES

	MOMENT	HOR. REACTION	THRUST
T.A.	0.32964920D-06	0.62500055D 00	0.62500055D 00
+.M.	0.51335598D-02	0.27099243D 00	0.27099244D 00
-.M.	-0.51332302D-02	0.35400812D 00	0.35400812D 00

LAMDA= 3.141593

INFLUENCE LINES FOR SECTION 1

MOMENT	THRUST	SHEAR
0.00000000D 00	0.62469505D 00	0.78086881D 00
-0.41351800D-01	0.64896367D 00	0.75458337D 00
-0.66497306D-01	0.71448102D 00	0.68123469D 00
-0.77326683D-01	0.80946530D 00	0.56998840D 00
-0.76053245D-01	0.92124326D 00	0.43109046D 00
-0.65181095D-01	0.10366901D 01	0.27559495D 00
-0.47428741D-01	0.11428434D 01	0.11493836D 00
-0.25615774D-01	0.12276700D 01	-0.39638030D-01
-0.25122025D-02	0.12809290D 01	-0.17773507D 00
0.19336455D-01	0.12956273D 01	-0.29079210D 00
0.37789144D-01	0.12657397D 01	-0.37228179D 00
0.51265703D-01	0.11926666D 01	-0.41874292D 00
0.58853904D-01	0.10793214D 01	-0.42979461D 00
0.60354563D-01	0.93285311D 00	-0.40815911D 00
0.56254533D-01	0.76342677D 00	-0.35933237D 00
0.47640164D-01	0.58338704D 00	-0.29103394D 00
0.36070059D-01	0.40634238D 00	-0.21253564D 00
0.23430047D-01	0.24629579D 00	-0.13397349D 00
0.11790945D-01	0.11691280D 00	-0.65725581D-01
0.32837456D-02	0.30971428D-01	-0.17906938D-01
-0.00000000D 00	-0.00000000D 00	-0.00000000D 00

INTEGRATION OF INFLUENCE LINES

	MOMENT	HOR. REACTION	THRUST
T.A.	-0.20946335D-05	0.62499468D 00	0.80038560D 00
+.M.	0.20344682D-01	0.42770030D 00	0.42413814D 00
-.M.	-0.20346777D-01	0.19729438D 00	0.37624746D 00

LAMDA= 3.141593

INFLUENCE LINES FOR SECTION 3

MOMENT	THRUST	SHEAR
0.00000000D 00	0.00000000D 00	0.00000000D 00
0.59640603D-02	0.30080748D-01	-0.21035183D-01
0.22950426D-01	0.11290603D 00	-0.78164311D-01
-0.48662179D-03	0.77057538D 00	0.67310292D 00
-0.15464035D-01	0.90653832D 00	0.55075332D 00
-0.23142644D-01	0.10455142D 01	0.40765697D 00
-0.24843856D-01	0.11733507D 01	0.25491288D 00
-0.22004960D-01	0.12769163D 01	0.10358423D 00
-0.16112751D-01	0.13450424D 01	-0.35962307D-01
-0.86192689D-02	0.13694579D 01	-0.15477868D 00
-0.84836974D-03	0.13455747D 01	-0.24602441D 00
0.60945502D-02	0.12729863D 01	-0.30551546D 00
0.11394205D-01	0.11555614D 01	-0.33202645D 00
0.14570786D-01	0.10011389D 01	-0.32731794D 00
0.15490041D-01	0.82084957D 00	-0.29587011D 00
0.14341230D-01	0.62820097D 00	-0.24439496D 00
0.11589897D-01	0.43807631D 00	-0.18121856D 00
0.79157694D-02	0.26578474D 00	-0.11563245D 00
0.41461692D-02	0.12626182D 00	-0.57295890D-01
0.11932015D-02	0.33469268D-01	-0.15740622D-01
-0.00000000D 00	-0.00000000D 00	-0.00000000D 00
	(SPECIAL JUMP POINT)	
	0.65133166D 00	0.76312574D 00

INTEGRATION OF INFLUENCE LINES

	MOMENT	HOR. REACTION	THRUST
T.A.	-0.15356367D-05	0.62499468D 00	0.76041369D 00
+.M.	0.56921238D-02	0.31657165D 00	0.32309730D 00
-.M.	-0.56936595D-02	0.30842303D 00	0.43731639D 00

LAMDA= 3.141593

INFLUENCE LINES FOR SECTION 5

MOMENT	THRUST	SHEAR
0.00000000D 00	0.00000000D 00	0.00000000D 00
0.35613563D-02	0.31198855D-01	-0.20608313D-01
0.14000772D-01	0.11680667D 00	-0.76974982D-01
0.30805451D-01	0.24379873D 00	-0.16011111D 00
0.53251643D-01	0.39800106D 00	-0.26010390D 00
0.80564709D-01	0.99285786D 00	0.52590561D 00
0.12473852D-01	0.11433362D 01	0.39588758D 00
-0.12391928D-02	0.12678999D 01	0.26137808D 00
-0.10906492D-01	0.13543600D 01	0.13198480D 00
-0.16968383D-01	0.13936177D 01	0.16271823D-01
-0.19956300D-01	0.13805198D 01	-0.78870189D-01
-0.20464665D-01	0.13144067D 01	-0.14875119D 00
-0.19115428D-01	0.11992276D 01	-0.19120766D 00
-0.16519404D-01	0.10432252D 01	-0.20669412D 00
-0.13240833D-01	0.85821540D 00	-0.19811405D 00
-0.97693434D-02	0.65860963D 00	-0.17044484D 00
-0.65020441D-02	0.46033972D 00	-0.13023170D 00
-0.37361361D-02	0.27983460D 00	-0.85036388D-01
-0.16706169D-02	0.13315601D 00	-0.42913864D-01
-0.41465742D-03	0.35346872D-01	-0.11966610D-01
-0.00000000D 00	-0.00000000D 00	-0.00000000D 00
	(SPECIAL JUMP POINT)	
	0.83962746D 00	0.65995107D 00

INTEGRATION OF INFLUENCE LINES

	MOMENT	HOR. REACTION	THRUST
T.A.	-0.86599154D-06	0.62499468D 00	0.72621225D 00
+.M.	0.70620785D-02	0.11500192D 00	0.15410043D 00
-.M.	-0.70629445D-02	0.50999275D 00	0.57211182D 00

LAMDA= 3.141593

INFLUENCE LINES FOR SECTION 7

MOMENT	THRUST	SHEAR
0.00000000D 00	0.00000000D 00	0.00000000D 00
0.14410786D-02	0.32511264D-01	-0.18367087D-01
0.60541597D-02	0.12152356D 00	-0.69125866D-01
0.14212136D-01	0.25315967D 00	-0.14502024D 00
0.26175830D-01	0.41234132D 00	-0.23769750D 00
0.42054670D-01	0.58328007D 00	-0.33891634D 00
0.61768526D-01	0.75017987D 00	-0.43887833D 00
0.35207382D-01	0.11994547D 01	0.41294515D 00
0.12806490D-01	0.13050055D 01	0.30904443D 00
-0.50100176D-02	0.13616041D 01	0.20914626D 00
-0.18055864D-01	0.13633610D 01	0.11954794D 00
-0.26407853D-01	0.13091060D 01	0.45089601D-01
-0.30405659D-01	0.12025373D 01	-0.11168546D-01
-0.30626639D-01	0.10519187D 01	-0.48104681D-01
-0.27838846D-01	0.86934212D 00	-0.66496335D-01
-0.22941050D-01	0.66971309D 00	-0.68813177D-01
-0.16899254D-01	0.46962370D 00	-0.58890090D-01
-0.10688115D-01	0.28627267D 00	-0.41542110D-01
-0.52429909D-02	0.13654680D 00	-0.22178227D-01
-0.14251401D-02	0.36322837D-01	-0.64559246D-02
-0.00000000D 00	-0.00000000D 00	-0.00000000D 00
	(SPECIAL JUMP POINT)	
	0.10857547D 01	0.60979298D 00

INTEGRATION OF INFLUENCE LINES

	MOMENT	HOR. REACTION	THRUST
T.A.	-0.15684071D-06	0.62499468D 00	0.67883116D 00
+.M.	0.97712088D-02	0.21406983D 00	0.23148913D 00
-.M.	-0.97713656D-02	0.41092485D 00	0.44734203D 00

LAMDA= 3.141593

INFLUENCE LINES FOR SECTION 9

MOMENT	THRUST	SHEAR
0.00000000D 00	0.00000000D 00	0.00000000D 00
-0.24255793D-03	0.33980414D-01	-0.13956522D-01
-0.31723599D-03	0.12698959D 00	-0.53217190D-01
0.76340264D-03	0.26446823D 00	-0.11326937D 00
0.39616422D-02	0.43057726D 00	-0.18882803D 00
0.10159663D-01	0.60670932D 00	-0.27392080D 00
0.20094766D-01	0.78222322D 00	-0.36207014D 00
0.34290028D-01	0.93538350D 00	-0.44656303D 00
0.52988793D-01	0.10544379D 01	-0.52081089D 00
0.26307437D-01	0.12847924D 01	0.39673248D 00
0.48183062D-02	0.13019174D 01	0.32436279D 00
-0.11071461D-01	0.12619526D 01	0.25398395D 00
-0.21349806D-01	0.11680585D 01	0.18931756D 00
-0.26393937D-01	0.10281341D 01	0.13312782D 00
-0.26926937D-01	0.85409210D 00	0.87110261D-01
-0.23947013D-01	0.66083862D 00	0.51887245D-01
-0.18642122D-01	0.46512529D 00	0.27097082D-01
-0.12303071D-01	0.28443927D 00	0.11549136D-01
-0.62454463D-02	0.13605038D 00	0.34127265D-02
-0.17466140D-02	0.36279242D-01	0.41114714D-03
0.00000000D 00	0.00000000D 00	0.00000000D 00
	(SPECIAL JUMP POINT)	
	0.12525041D 01	0.71710207D 00

INTEGRATION OF INFLUENCE LINES

	MOMENT	HOR. REACTION	THRUST
T.A.	0.45710602D-06	0.62499468D 00	0.64054867D 00
+.M.	0.74500816D-02	0.31621780D 00	0.31785203D 00
-.M.	-0.74496245D-02	0.30877688D 00	0.32269665D 00

LAMDA= 3.141593

INFLUENCE LINES FOR SECTION 11

MOMENT	THRUST	SHEAR
0.00000000D 00	0.00000000D 00	0.00000000D 00
-0.13405711D-02	0.35371012D-01	-0.76446706D-02
-0.45534020D-02	0.13235206D 00	-0.30131336D-01
-0.83676992D-02	0.27601739D 00	-0.66413014D-01
-0.11470335D-01	0.45007023D 00	-0.11488825D 00
-0.12563043D-01	0.63735646D 00	-0.17335415D 00
-0.10435797D-01	0.82060964D 00	-0.23899744D 00
-0.40523035D-02	0.98341127D 00	-0.30843872D 00
0.73606451D-02	0.11112994D 01	-0.37784124D 00
0.24232040D-01	0.11929033D 01	-0.44308580D 00
0.46587687D-01	0.12209397D 01	-0.50000001D 00
0.24232042D-01	0.11929033D 01	0.44308580D 00
0.73606478D-02	0.11112994D 01	0.37784125D 00
-0.40523004D-02	0.98341130D 00	0.30843873D 00
-0.10435794D-01	0.82060966D 00	0.23899746D 00
-0.12563040D-01	0.63735648D 00	0.17335417D 00
-0.11470333D-01	0.45007025D 00	0.11488826D 00
-0.83676982D-02	0.27601739D 00	0.66413022D-01
-0.45534015D-02	0.13235206D 00	0.30131339D-01
-0.13405709D-02	0.35371012D-01	0.76446717D-02
0.00000000D 00	0.00000000D 00	0.00000000D 00
	(SPECIAL JUMP POINT)	
	0.12209398D 01	0.94964159D 00

INTEGRATION OF INFLUENCE LINES

	MOMENT	HOR. REACTION	THRUST
T.A.	0.78761878D-06	0.62499468D 00	0.62499468D 00
+.M.	0.52665747D-02	0.27263105D 00	0.27263105D 00
-.M.	-0.52657871D-02	0.35236363D 00	0.35236363D 00

LAMDA= 3.769911

INFLUENCE LINES FOR SECTION 1

MOMENT	THRUST	SHEAR
0.00000000D 00	0.62469505D 00	0.78086881D 00
-0.41670084D-01	0.64852143D 00	0.75544933D 00
-0.67522229D-01	0.71322988D 00	0.68390245D 00
-0.79119158D-01	0.80802234D 00	0.57440516D 00
-0.78426099D-01	0.92027059D 00	0.43652489D 00
-0.67786586D-01	0.10369681D 01	0.28096982D 00
-0.49854498D-01	0.11448946D 01	0.11915335D 00
-0.27476283D-01	0.12315746D 01	-0.37432354D-01
-0.35236717D-02	0.12862624D 01	-0.17809027D 00
0.19366061D-01	0.13009320D 01	-0.29332977D 00
0.38704645D-01	0.12711161D 01	-0.37658407D 00
0.52943436D-01	0.11964374D 01	-0.42394792D 00
0.61007377D-01	0.10807011D 01	-0.43495190D 00
0.62656977D-01	0.93155748D 00	-0.41245376D 00
0.58402621D-01	0.75976413D 00	-0.36225970D 00
0.49406363D-01	0.57820379D 00	-0.29248567D 00
0.37333997D-01	0.40082654D 00	-0.21278017D 00
0.24185740D-01	0.24166969D 00	-0.13353565D 00
0.12131057D-01	0.11405721D 00	-0.65188380D-01
0.33656592D-02	0.30029404D-01	-0.17665704D-01
-0.00000000D 00	-0.00000000D 00	-0.00000000D 00

INTEGRATION OF INFLUENCE LINES

	MOMENT	HOR. REACTION	THRUST
T.A.	-0.40717045D-05	0.62498801D 00	0.80038007D 00
+.M.	0.20998474D-01	0.42718634D 00	0.42261196D 00
-.M.	-0.21002546D-01	0.19780167D 00	0.37776812D 00

LAMDA= 3.769911

INFLUENCE LINES FOR SECTION 3

MOMENT	THRUST	SHEAR
0.00000000D 00	0.00000000D 00	0.00000000D 00
0.59354741D-02	0.31207469D-01	-0.18961423D-01
0.22788510D-01	0.11826945D 00	-0.70086536D-01
-0.95805282D-03	0.78208612D 00	0.68758191D 00
-0.16300086D-01	0.92426422D 00	0.56844739D 00
-0.24259283D-01	0.10693550D 01	0.42535726D 00
-0.26068925D-01	0.12027636D 01	0.26978270D 00
-0.23131791D-01	0.13107570D 01	0.11349576D 00
-0.16950241D-01	0.13815546D 01	-0.32198117D-01
-0.90317970D-02	0.14064213D 01	-0.15732764D 00
-0.78001814D-03	0.13805884D 01	-0.25410590D 00
0.66144935D-02	0.13038301D 01	-0.31762636D 00
0.12263092D-01	0.11805527D 01	-0.34626356D 00
0.15638440D-01	0.10194072D 01	-0.34173832D 00
0.16591255D-01	0.83245996D 00	-0.30881676D 00
0.15327843D-01	0.63409764D 00	-0.25473236D 00
0.12356433D-01	0.43985207D 00	-0.18844659D 00
0.84149626D-02	0.26531415D 00	-0.11987427D 00
0.43932250D-02	0.12525163D 00	-0.59176844D-01
0.12597545D-02	0.32982203D-01	-0.16188399D-01
-0.00000000D 00	-0.00000000D 00	-0.00000000D 00
	(SPECIAL JUMP POINT)	
	0.65115713D 00	0.76255048D 00

INTEGRATION OF INFLUENCE LINES

	MOMENT	HOR. REACTION	THRUST
T.A.	-0.28888962D-05	0.62498801D 00	0.77654910D 00
+.M.	0.59817910D-02	0.31683189D 00	0.32923739D 00
-.M.	-0.59846799D-02	0.30815612D 00	0.44731172D 00

LAMDA= 3.769911

INFLUENCE LINES FOR SECTION 5

MOMENT	THRUST	SHEAR
0.00000000D 00	0.00000000D 00	0.00000000D 00
0.36869956D-02	0.31580654D-01	-0.19885934D-01
0.14451426D-01	0.11927007D 00	-0.74353270D-01
0.31652441D-01	0.25111380D 00	-0.15375938D 00
0.54368539D-01	0.41351603D 00	-0.24770106D 00
0.81635338D-01	0.10180427D 01	0.54334295D 00
0.13250516D-01	0.11772416D 01	0.41392765D 00
-0.87675851D-03	0.13088523D 01	0.27643372D 00
-0.10971886D-01	0.13999631D 01	0.14159566D 00
-0.17396123D-01	0.14409314D 01	0.19242379D-01
-0.20633064D-01	0.14263924D 01	-0.82502404D-01
-0.21260068D-01	0.13558965D 01	-0.15791364D 00
-0.19908458D-01	0.12340212D 01	-0.20411658D 00
-0.17217070D-01	0.10699648D 01	-0.22124858D 00
-0.13787726D-01	0.87665916D 00	-0.21228568D 00
-0.10148387D-01	0.66958938D 00	-0.18260150D 00
-0.67281913D-02	0.46552288D 00	-0.13935345D 00
-0.38455415D-02	0.28133044D 00	-0.90808043D-01
-0.17078925D-02	0.13302522D 00	-0.45701695D-01
-0.42038550D-03	0.35076944D-01	-0.12701997D-01
-0.00000000D 00	-0.00000000D 00	-0.00000000D 00
	(SPECIAL JUMP POINT)	
	0.84192234D 00	0.64481205D 00

INTEGRATION OF INFLUENCE LINES

	MOMENT	HOR. REACTION	THRUST
T.A.	-0.15284586D-05	0.62498801D 00	0.74615243D 00
+.M.	0.72905300D-02	0.11476972D 00	0.15984065D 00
-.M.	-0.72920584D-02	0.51019829D 00	0.58731177D 00

LAMDA= 3.769911

INFLUENCE LINES FOR SECTION 7

MOMENT	THRUST	SHEAR
0.00000000D 00	0.00000000D 00	0.00000000D 00
0.15688226D-02	0.32159867D-01	-0.18877822D-01
0.65388044D-02	0.12109967D 00	-0.70852173D-01
0.15215056D-01	0.25410574D 00	-0.14797025D 00
0.27747109D-01	0.41681200D 00	-0.24111087D 00
0.44083915D-01	0.59367572D 00	-0.34025894D 00
0.63934398D-01	0.76871170D 00	-0.43494957D 00
0.87016373D-01	0.92262783D 01	0.42201241D 00
0.13902190D-01	0.13380088D 01	0.31935633D 00
-0.47750256D-02	0.13980312D 01	0.21786761D 00
-0.18648725D-01	0.14001334D 01	0.12499375D 00
-0.27660976D-01	0.13432480D 01	0.46669837D-01
-0.32071934D-01	0.12316120D 01	-0.13133687D-01
-0.32435916D-01	0.10743814D 01	-0.52665426D-01
-0.29547116D-01	0.88472968D 00	-0.72393409D-01
-0.24366243D-01	0.67862778D 00	-0.74783753D-01
-0.17940728D-01	0.47351422D 00	-0.63916466D-01
-0.11330165D-01	0.28705045D 00	-0.45018036D-01
-0.55450574D-02	0.13609669D 00	-0.23986481D-01
-0.15026577D-02	0.35971815D-01	-0.69654851D-02
-0.00000000D 00	-0.00000000D 00	-0.00000000D 00
	(SPECIAL JUMP POINT)	
	0.10935082D 01	0.58003939D 00

INTEGRATION OF INFLUENCE LINES

	MOMENT	HOR. REACTION	THRUST
T.A.	-0.15639366D-06	0.62498801D 00	0.69267256D 00
+.M.	0.10290023D-01	0.21425658D 00	0.23658050D 00
-.M.	-0.10290180D-01	0.41073143D 00	0.45609207D 00

LAMDA= 3.769911

INFLUENCE LINES FOR SECTION a

MOMENT	THRUST	SHEAR
0.000000000D 00	0.000000000D 00	0.000000000D 00
-0.19917675D-03	0.33159415D-01	-0.14965147D-01
-0.13665966D-03	0.12469762D 00	-0.56954690D-01
0.11801232D-02	0.26124044D 00	-0.12079923D 00
0.47038297D-02	0.42769562D 00	-0.20028029D 00
0.11281012D-01	0.60775687D 00	-0.28825685D 00
0.21575912D-01	0.78467840D 00	-0.37693172D 00
0.35991769D-01	0.94230661D 00	-0.45822536D 00
0.54600834D-01	0.10662952D 01	-0.52431199D 00
0.27389763D-01	0.13096047D 01	0.40206196D 00
0.51184213D-02	0.13194350D 01	0.33464637D 00
-0.11570953D-01	0.12786561D 01	0.26613348D 00
-0.22492679D-01	0.11823634D 01	0.20111389D 00
-0.27923559D-01	0.10385343D 01	0.14319773D 00
-0.28558631D-01	0.86015844D 00	0.94818430D-01
-0.25429111D-01	0.66302577D 00	0.57171688D-01
-0.19798762D-01	0.46458548D 00	0.30281241D-01
-0.13056199D-01	0.28267392D 00	0.13159970D-01
-0.66172890D-02	0.13445453D 00	0.40259427D-02
-0.18464258D-02	0.35639428D-01	0.53493154D-03
0.000000000D 00	0.000000000D 00	0.000000000D 00
	(SPECIAL JUMP POINT)	
	0.12637811D 01	0.70997475D 00

INTEGRATION OF INFLUENCE LINES

	MOMENT	HOR. REACTION	THRUST
T.A.	0.98204217D-06	0.62498801D 00	0.64502339D 00
+.M.	0.78748248D-02	0.31710914D 00	0.32056934D 00
-.M.	-0.78738428D-02	0.30787887D 00	0.32445405D 00

LAMDA= 3.769911

INFLUENCE LINES FOR SECTION 11

MOMENT	THRUST	SHEAR
0.00000000D 00	0.00000000D 00	0.00000000D 00
-0.13928248D-02	0.34484718D-01	-0.84334138D-02
-0.47340737D-02	0.12976663D 00	-0.33178858D-01
-0.86976406D-02	0.27213150D 00	-0.72885654D-01
-0.11905263D-01	0.44591587D 00	-0.12544586D 00
-0.12996829D-01	0.63421587D 00	-0.18794475D 00
-0.10720380D-01	0.81957832D 00	-0.25667378D 00
-0.40359251D-02	0.98508244D 00	-0.32722732D 00
0.77783589D-02	0.11155985D 01	-0.39469577D 00
0.25033543D-01	0.11990994D 01	-0.45395125D 00
0.47568831D-01	0.12278256D 01	-0.50000001D 00
0.25033545D-01	0.11990994D 01	0.45395125D 00
0.77783611D-02	0.11155986D 01	0.39469578D 00
-0.40359216D-02	0.98508247D 00	0.32722733D 00
-0.10720377D-01	0.81957834D 00	0.25667380D 00
-0.12996825D-01	0.63421589D 00	0.18794477D 00
-0.11905261D-01	0.44591588D 00	0.12544587D 00
-0.86976394D-02	0.27213151D 00	0.72885663D-01
-0.47340732D-02	0.12978664D 00	0.33178863D-01
-0.13928247D-02	0.34484719D-01	0.84334150D-02
0.00000000D 00	0.00000000D 00	0.00000000D 00
	(SPECIAL JUMP POINT)	
	0.12278257D 01	0.10072042D 01

INTEGRATION OF INFLUENCE LINES

	MOMENT	HOR. REACTION	THRUST
T.A.	0.15813488D-05	0.62498801D 00	0.62498801D 00
+.M.	0.54387705D-02	0.27471879D 00	0.27471879D 00
-.M.	-0.54371891D-02	0.35026922D 00	0.35026922D 00

LAMDA= 4.398230

INFLUENCE LINES FOR SECTION 1

MOMENT	THRUST	SHEAR
0.00000000D 00	0.62469595D 00	0.78086881D 00
-0.42072619D-01	0.64798685D 00	0.75653397D 00
-0.68829342D-01	0.71194070D 00	0.68727172D 00
-0.81426168D-01	0.80629823D 00	0.58003163D 00
-0.81506651D-01	0.91916272D 00	0.44351225D 00
-0.71199511D-01	0.10374538D 01	0.28795676D 00
-0.53063583D-01	0.11476276D 01	0.12472029D 00
-0.29969325D-01	0.12366459D 01	-0.34406332D-01
-0.49157030D-02	0.12931174D 01	-0.17868463D 00
0.19204270D-01	0.13084629D 01	-0.29643608D 00
0.39860015D-01	0.12779095D 01	-0.38202036D 00
0.55121979D-01	0.12011197D 01	-0.43061508D 00
0.63833268D-01	0.10822869D 01	-0.44162285D 00
0.65696146D-01	0.92971742D 00	-0.41806698D 00
0.61249214D-01	0.75493206D 00	-0.36614915D 00
0.51753909D-01	0.57149315D 00	-0.29449411D 00
0.39018547D-01	0.39376591D 00	-0.21323376D 00
0.25196007D-01	0.23580162D 00	-0.13308913D 00
0.12587657D-01	0.11046494D 00	-0.64572986D-01
0.34763590D-02	0.28853851D-01	-0.17382380D-01
-0.00000000D 00	-0.00000000D 00	-0.00000000D 00

INTEGRATION OF INFLUENCE LINES

	MOMENT	HOR. REACTION	THRUST
T.A.	-0.68160737D-05	0.62498088D 00	0.80037407D 00
+.M.	0.21857985D-01	0.42653243D 00	0.42063867D 00
-.M.	-0.21864802D-01	0.19844845D 00	0.37973540D 00

LAMDA= 4.398230

INFLUENCE LINES FOR SECTION 3

MOMENT	THRUST	SHEAR
0.00000000D 00	0.00000000D 00	0.00000000D 00
0.58922407D-02	0.32822908D-01	-0.16322923D-01
0.22560529D-01	0.12574690D 00	-0.59858474D-01
-0.15920576D-02	0.79819334D 00	0.70599921D 00
-0.17409082D-01	0.94945430D 00	0.50120719D 00
-0.25735798D-01	0.11036993D 01	0.44841866D 00
-0.27690103D-01	0.12455929D 01	0.28945033D 00
-0.24626773D-01	0.13604603D 01	0.12690095D 00
-0.18065480D-01	0.14355858D 01	-0.26743517D-01
-0.95348618D-02	0.14615294D 01	-0.16017285D 00
-0.69350755D-03	0.14332382D 01	-0.26432485D 00
0.73040170D-02	0.13507318D 01	-0.33329416D 00
0.13419794D-01	0.12191786D 01	-0.36487081D 00
0.17061676D-01	0.10483860D 01	-0.36071518D 00
0.18059576D-01	0.85175177D 00	-0.32592675D 00
0.16642651D-01	0.64491250D 00	-0.26843568D 00
0.13376792D-01	0.44432864D 00	-0.19805166D 00
0.90783885D-02	0.26601803D 00	-0.12552470D 00
0.47209343D-02	0.12457469D 00	-0.61690040D-01
0.13478630D-02	0.32524305D-01	-0.16789490D-01
-0.00000000D 00	-0.00000000D 00	-0.00000000D 00
	(SPECIAL JUMP POINT)	
	0.65100485D 00	0.76085708D 00

INTEGRATION OF INFLUENCE LINES

	MOMENT	HOR. REACTION	THRUST
T.A.	-0.48618735D-05	0.62498088D 00	0.80093359D 00
+.M.	0.63671481D-02	0.31710204D 00	0.33883327D 00
-.M.	-0.63720100D-02	0.30787884D 00	0.46210032D 00

LAMDA= 4.398230

INFLUENCE LINES FOR SECTION 5

MOMENT	THRUST	SHEAR
0.000000000D 00	0.000000000D 00	0.000000000D 00
0.38464392D-02	0.32368449D-01	-0.19108407D-01
0.15023350D-01	0.12355318D 00	-0.76723525D-01
0.32728141D-01	0.26285284D 00	-0.14512577D 00
0.55792305D-01	0.43724781D 00	-0.23127689D 00
0.83015676D-01	0.10558585D 01	0.56621615D 00
0.14272054D-01	0.12280617D 01	0.43768577D 00
-0.37621209D-03	0.13704081D 01	0.29642550D 00
-0.11020832D-01	0.14686229D 01	0.15452635D 00
-0.17919773D-01	0.15127855D 01	0.23429105D-01
-0.21490863D-01	0.14965588D 01	-0.87111740D-01
-0.22284795D-01	0.14199569D 01	-0.16996369D 00
-0.20941381D-01	0.12884461D 01	-0.22125864D 00
-0.18133701D-01	0.11126021D 01	-0.24067038D 00
-0.14511861D-01	0.90697348D 00	-0.23124793D 00
-0.10654272D-01	0.68860795D 00	-0.19888919D 00
-0.70329087D-02	0.47550292D 00	-0.15157874D 00
-0.39950076D-02	0.28521404D 00	-0.98539933D-01
-0.17600895D-02	0.13377282D 00	-0.49432595D-01
-0.42889877D-03	0.34971755D-01	-0.13684853D-01
-0.00000000D 00	-0.00000000D 00	-0.00000000D 00
	(SPECIAL JUMP POINT)	
	0.84536653D 00	0.61897041D 00

INTEGRATION OF INFLUENCE LINES

	MOMENT	HOR. REACTION	THRUST
T.A.	-0.25011540D-05	0.62498088D 00	0.77714171D 00
+.M.	0.75853774D-02	0.11453657D 00	0.16594806D 00
-.M.	-0.75878785D-02	0.51044431D 00	0.61119365D 00

LAMDA= 4.398239

INFLUENCE LINES FOR SECTION 7

MOMENT	THRUST	SHEAR
0.000000000D 00	0.000000000D 00	0.000000000D 00
0.17384163D-02	0.31979968D-01	-0.19490249D-01
0.71814900D-02	0.12141772D 00	-0.72904805D-01
0.16542338D-01	0.25713286D 00	-0.15142474D 00
0.29821201D-01	0.42554951D 00	-0.24474113D 00
0.46756149D-01	0.61132777D 00	-0.34143280D 00
0.66786832D-01	0.79807969D 00	-0.42957817D 00
0.89415894D-01	0.12674684D 01	0.43371488D 00
0.15380059D-01	0.13881521D 01	0.33259421D 00
-0.44253051D-02	0.14532527D 01	0.22905179D 00
-0.19398219D-01	0.14560259D 01	0.13193541D 00
-0.29298493D-01	0.13954985D 01	0.48570104D-01
-0.34274198D-01	0.12766396D 01	-0.15882491D-01
-0.34842857D-01	0.11098548D 01	-0.58827729D-01
-0.31829477D-01	0.90984609D 00	-0.80308182D-01
-0.26275923D-01	0.69409834D 00	-0.82774800D-01
-0.19338922D-01	0.48126489D 00	-0.76630600D-01
-0.12193178D-01	0.28970010D 00	-0.49652134D-01
-0.59513945D-02	0.13630180D 00	-0.26392069D-01
-0.16069963D-02	0.35731470D-01	-0.76418053D-02
-0.000000000D 00	-0.000000000D 00	-0.000000000D 00
	(SPECIAL JUMP POINT)	
	0.11046147D 01	0.52834368D 00

INTEGRATION OF INFLUENCE LINES

	MOMENT	HOR. REACTION	THRUST
T.A.	-0.84623905D-07	0.62498088D 00	0.71461848D 00
+.M.	0.10978093D-01	0.21450006D 00	0.24455388D 00
-.M.	-0.10978178D-01	0.41048082D 00	0.47006461D 00

LAMDA= 4.398230

INFLUENCE LINES FOR SECTION 9

MOMENT	THRUST	SHEAR
0.00000000D 00	0.00000000D 00	0.00000000D 00
-0.13752242D-03	0.32203467D-01	-0.16294823D-01
0.11747118D-03	0.12208368D 00	-0.61878883D-01
0.17598063D-02	0.25773090D 00	-0.13070537D 00
0.57233730D-02	0.42498840D 00	-0.21531426D 00
0.12801556D-01	0.60792472D 00	-0.30702811D 00
0.23558458D-01	0.78963983D 00	-0.39633783D 00
0.38241577D-01	0.95340126D 00	-0.47348776D 00
0.56710810D-01	0.10840307D 01	-0.52922882D 00
0.28799361D-01	0.13236281D 01	0.40842733D 00
0.55016106D-02	0.13447653D 01	0.34762396D 00
-0.12240605D-01	0.13033742D 01	0.28184048D 00
-0.24013771D-01	0.12033704D 01	0.21664458D 00
-0.29959246D-01	0.10542264D 01	0.15666905D 00
-0.30731661D-01	0.86989993D 00	0.10528763D 00
-0.27403975D-01	0.66736276D 00	0.64595210-01
-0.21340707D-01	0.46499795D 00	0.34745392D-01
-0.14059643D-01	0.28111764D 00	0.15461715D-01
-0.71124338D-02	0.13277203D 00	0.49233015D-02
-0.19792366D-02	0.34926169D-01	0.72206637D-03
0.00000000D 00	0.00000000D 00	0.00000000D 00
	(SPECIAL JUMP POINT)	
	0.12795050D 01	0.69248548D 00

INTEGRATION OF INFLUENCE LINES

	MOMENT	HOR. REACTION	THRUST
T.A.	0.19264592D-05	0.62498088D 00	0.65220255D 00
+.M.	0.84442283D-02	0.31919827D 00	0.32567055D 00
-.M.	-0.84423019D-02	0.30578261D 00	0.32653200D 00

LAMDA= 4.399230

INFLUENCE LINES FOR SECTION 11

MOMENT	THRUST	SHEAR
0.0000000D 00	0.0000000D 00	0.0000000D 00
-0.14595383D-02	0.33389779D-01	-0.95104605D-02
-0.49645175D-02	0.12659712D 00	-0.37334643D-01
-0.91179245D-02	0.26727041D 00	-0.81690375D-01
-0.12458055D-01	0.44068586D 00	-0.13975421D 00
-0.13546002D-01	0.63023056D 00	-0.20761828D 00
-0.11077359D-01	0.81823494D 00	-0.28035012D 00
-0.40094283D-02	0.98715229D 00	-0.35218411D 00
0.83119953D-02	0.11210043D 01	-0.41685610D 00
0.26047873D-01	0.12069207D 01	-0.46806370D 00
0.48806067D-01	0.12365266D 01	-0.50000001D 00
0.26047975D-01	0.12069207D 01	0.46806370D 00
0.83119991D-02	0.11210044D 01	0.41685611D 00
-0.40094240D-02	0.98715232D 00	0.35218412D 00
-0.11077355D-01	0.81823496D 00	0.28035013D 00
-0.13545998D-01	0.63023058D 00	0.20761830D 00
-0.12458053D-01	0.44068587D 00	0.13975422D 00
-0.91179230D-02	0.26727042D 00	0.81690385D-01
-0.49645168D-02	0.12659713D 00	0.37334647D-01
-0.14595382D-02	0.33389780D-01	0.95104618D-02
0.0000000D 00	0.0000000D 00	0.0000000D 00
	(SPECIAL JUMP POINT)	
	0.12365267D 01	0.10951584D 01

INTEGRATION OF INFLUENCE LINES

	MOMENT	HOR. REACTION	THRUST
T.A.	0.30049446D-05	0.62498088D 00	0.62498088D 00
+.M.	0.56573478D-02	0.27731845D 00	0.27731845D 00
-.M.	-0.56543429D-02	0.34766243D 00	0.34766243D 00

Appendix 3

INFLUENCE LINE CURVES

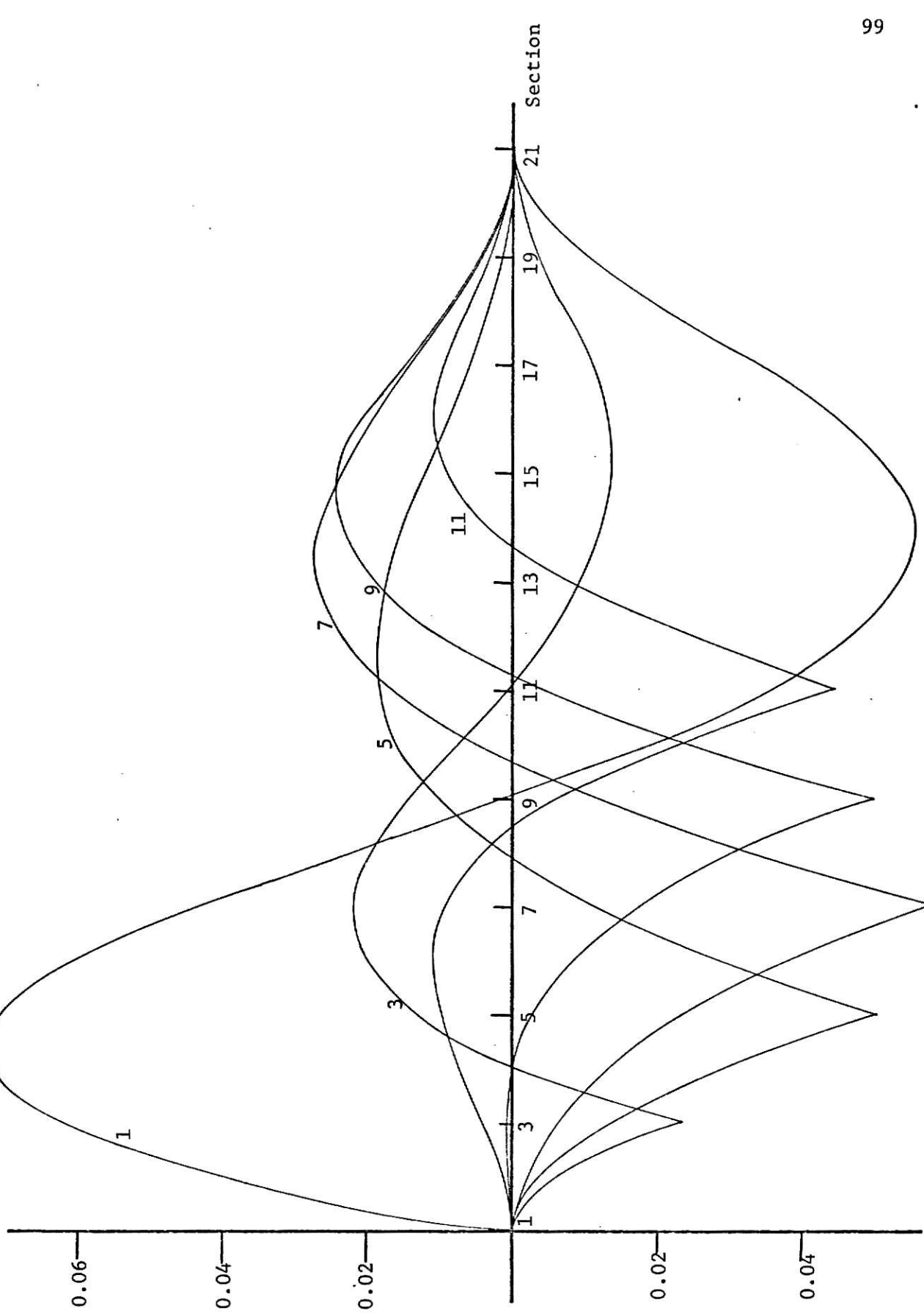

Figure 10. Influence lines of moment $\lambda = 0.\pi$

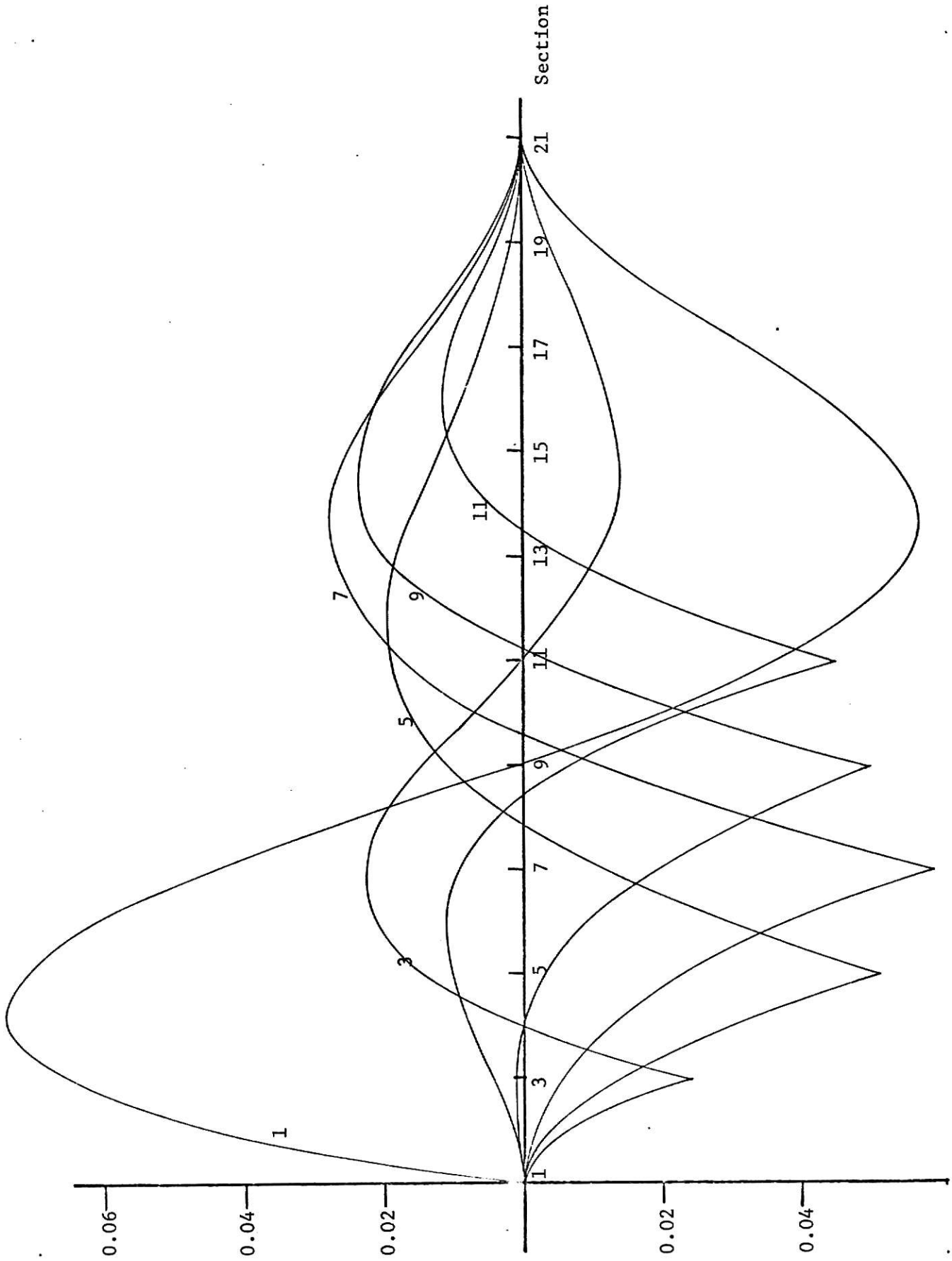

Figure 11. Influence lines of moment $\lambda = 0.4\pi$

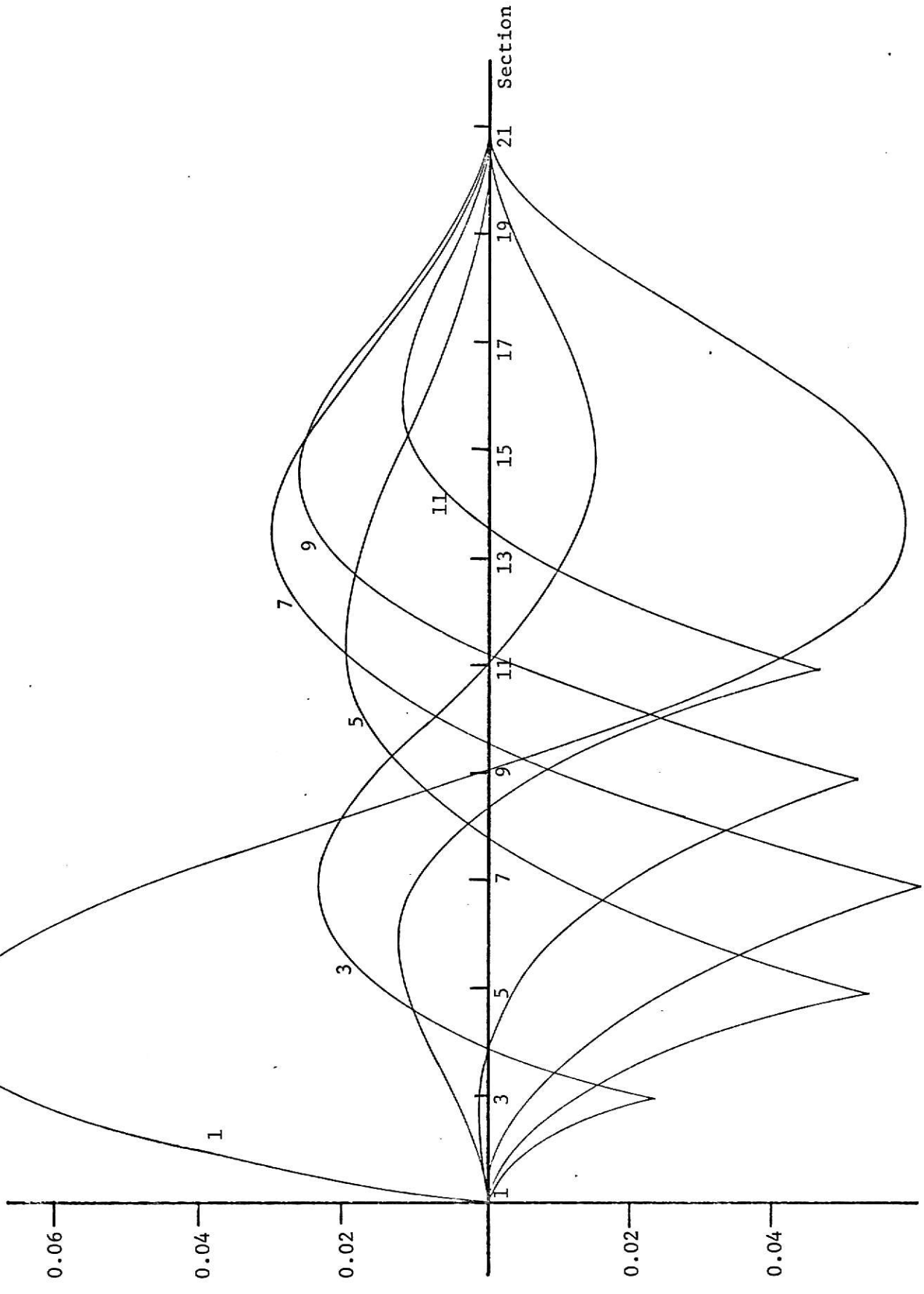

Figure 12. Influence lines of moment $\lambda = 0.8\pi$

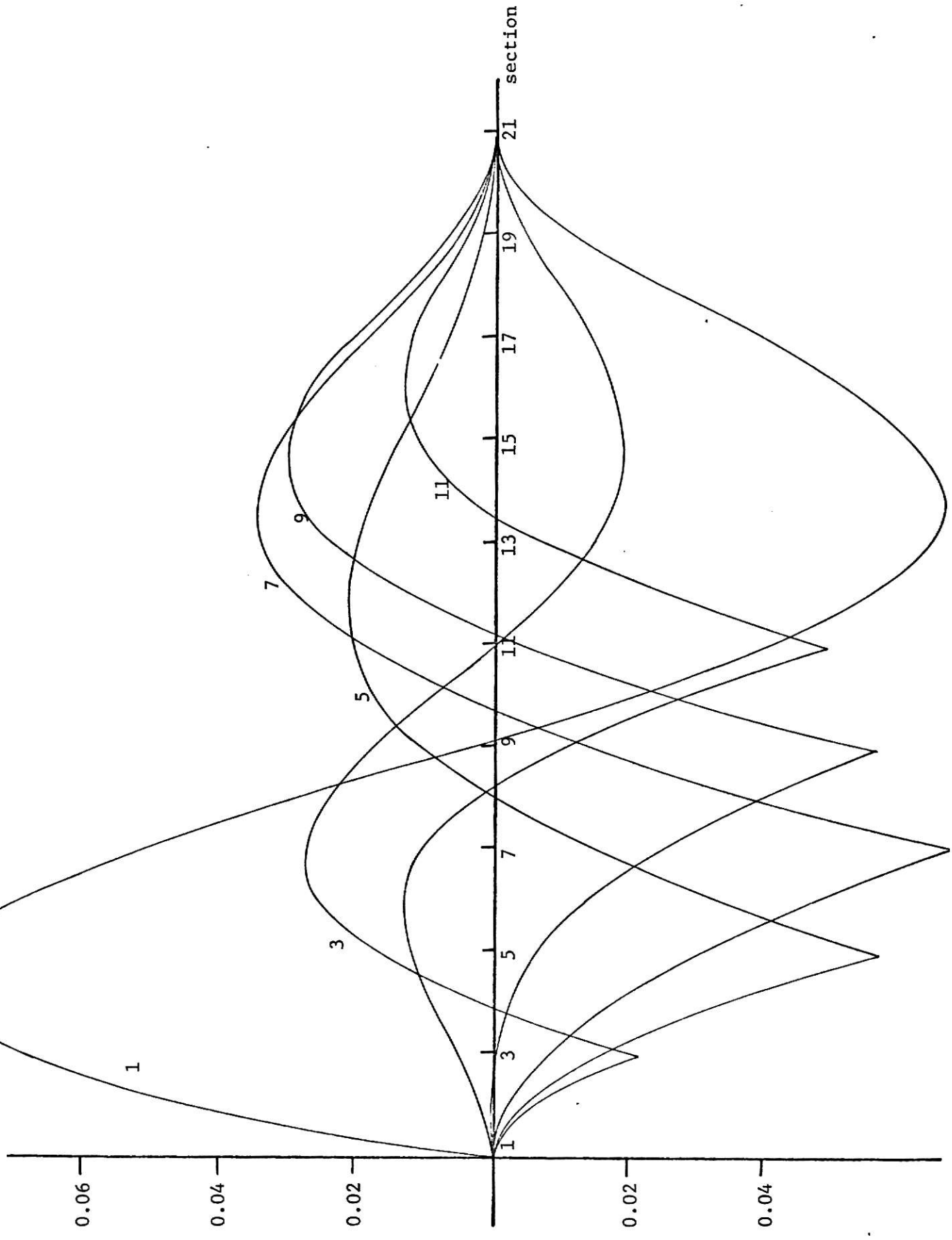

Figure 13. Influence lines of moment $\lambda = 1.4\pi$

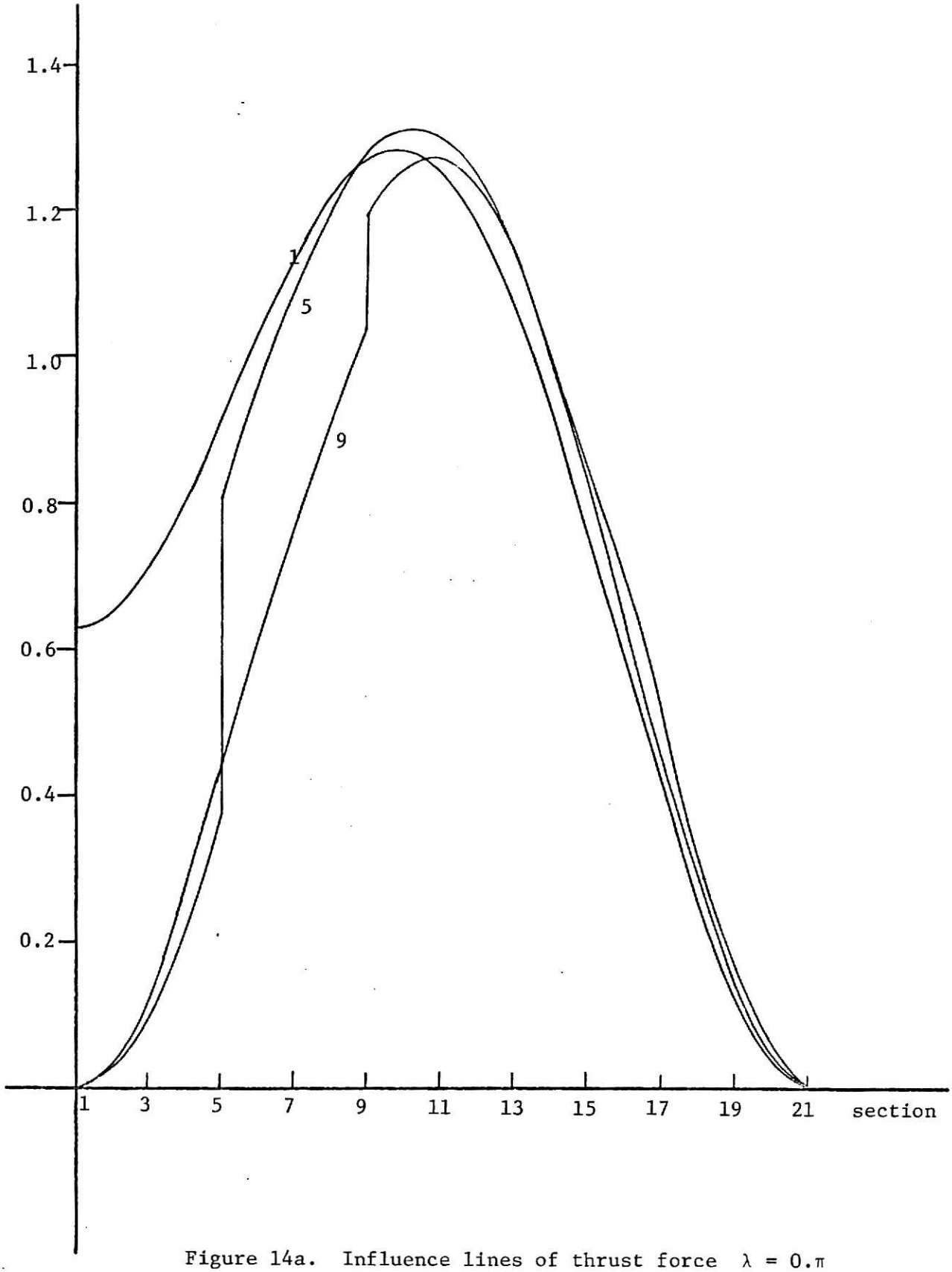

Figure 14a. Influence lines of thrust force $\lambda = 0.\pi$

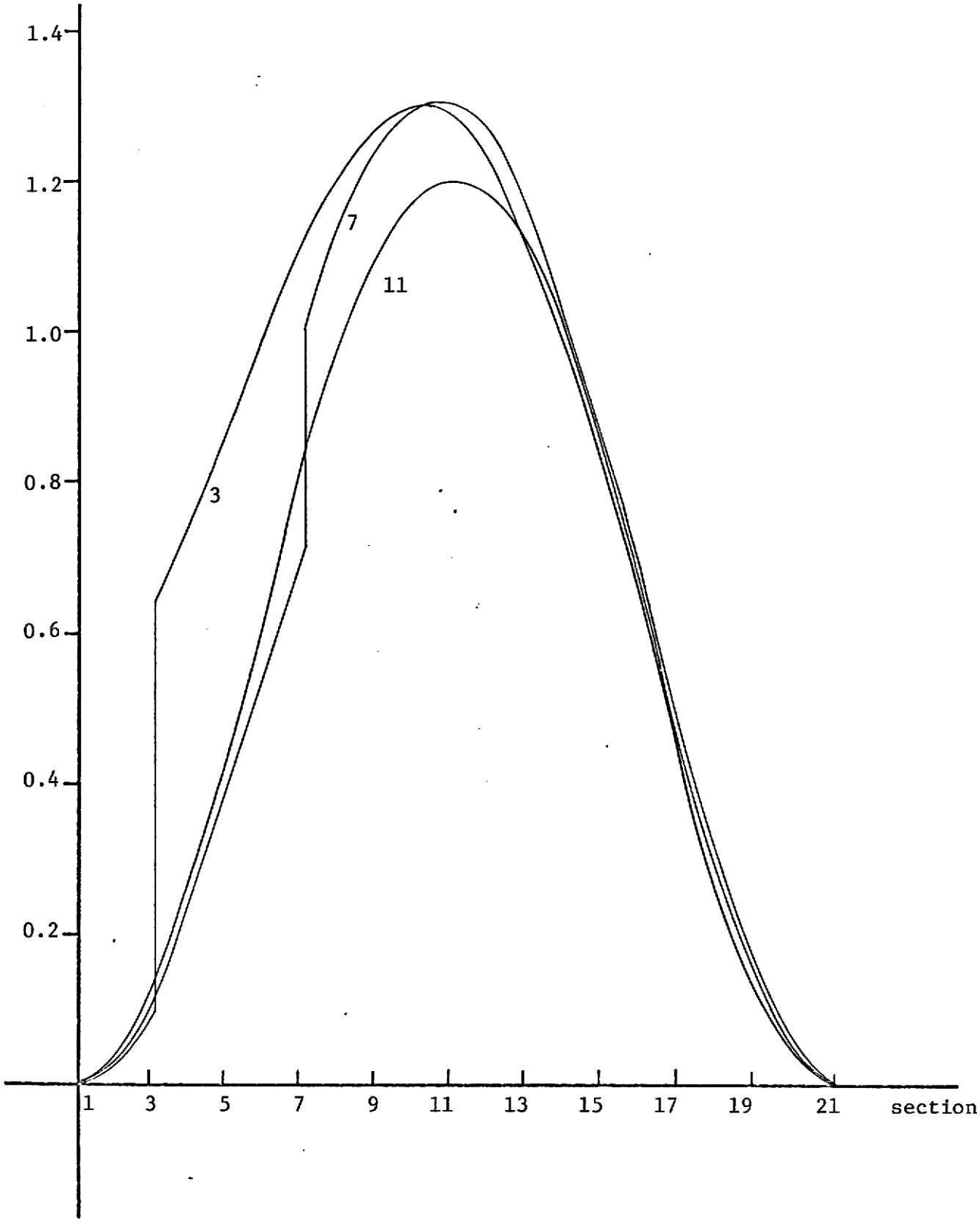

Figure 14b. Influence lines of thrust force $\lambda = 0.\pi$

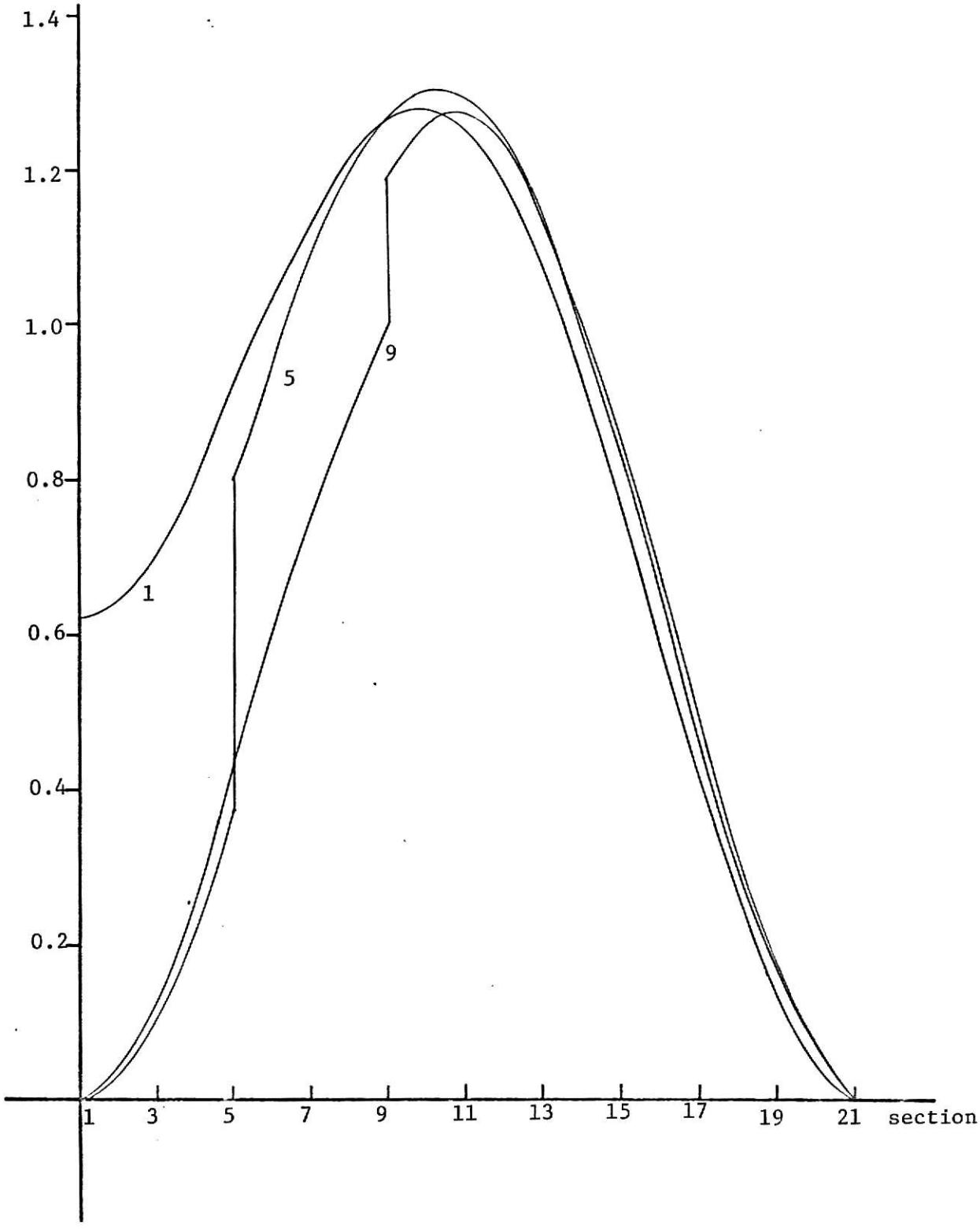

Figure 15a. Influence lines of thrust force

$\lambda = 0.4\pi$

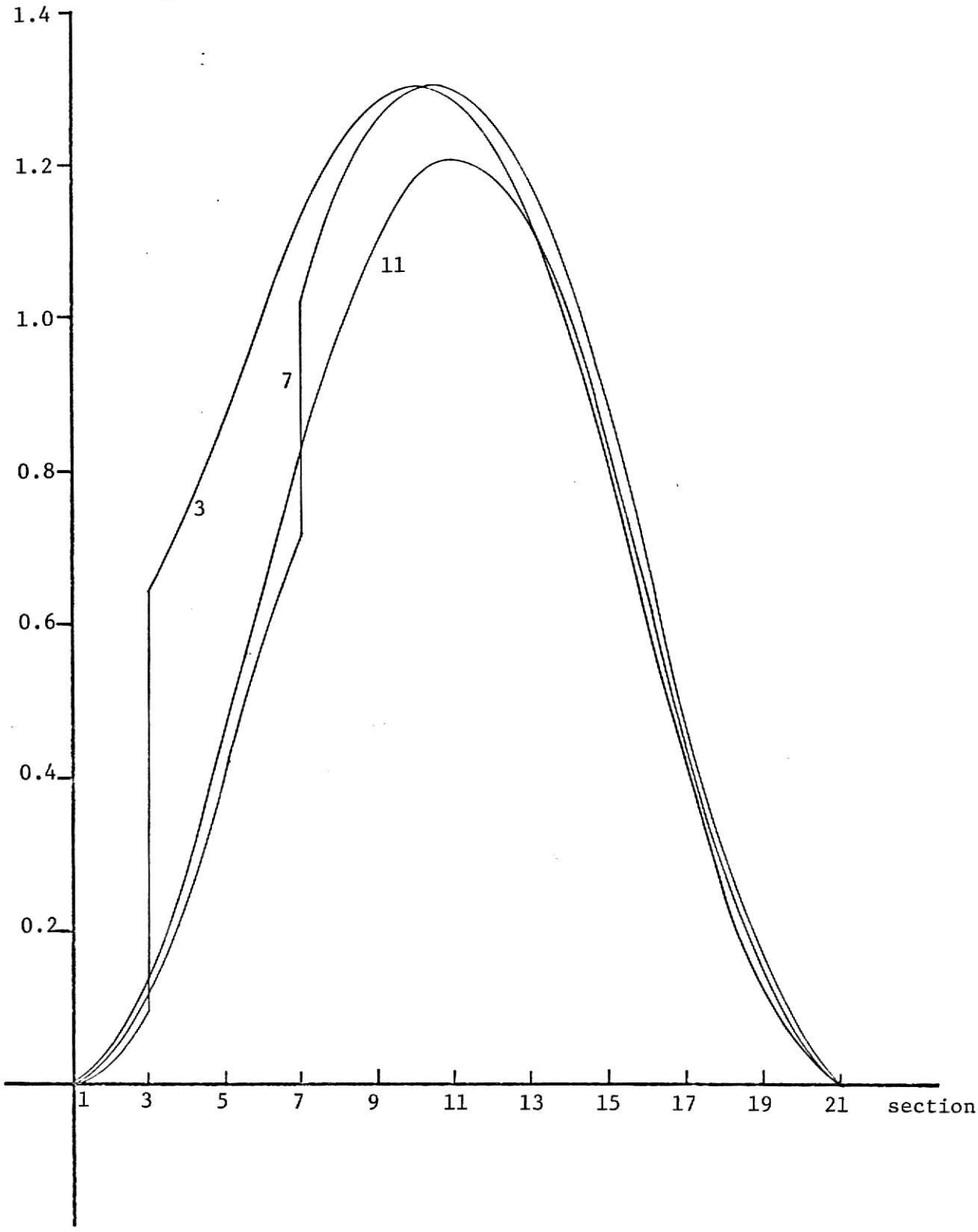

Figure 16b. Influence lines of thrust force $\lambda = 0.4\pi$

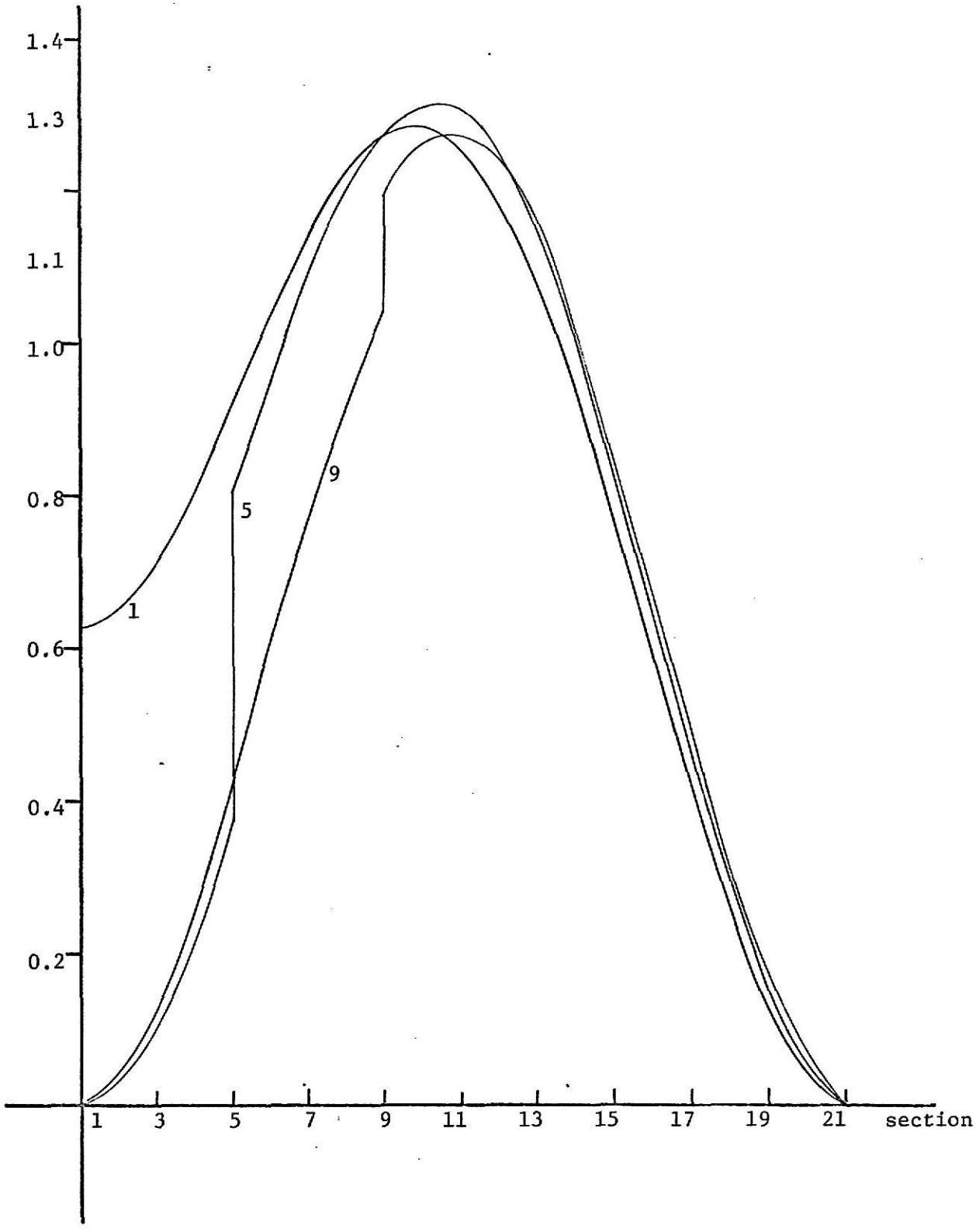

Figure 17a. Influence lines of thrust force $\lambda = 0.8\pi$

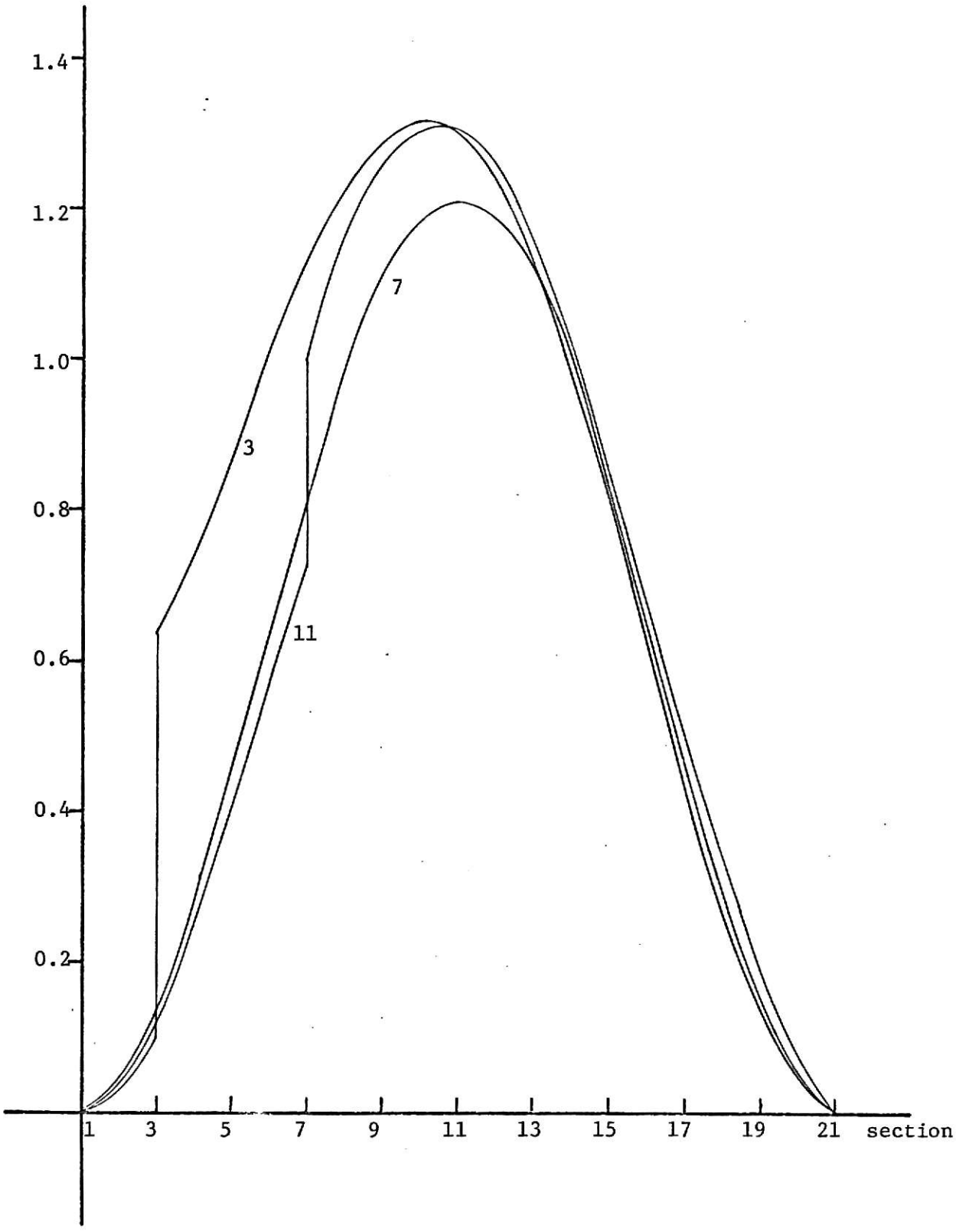

Figure 17b. Influence lines of thrust force $\lambda = 0.8\pi$

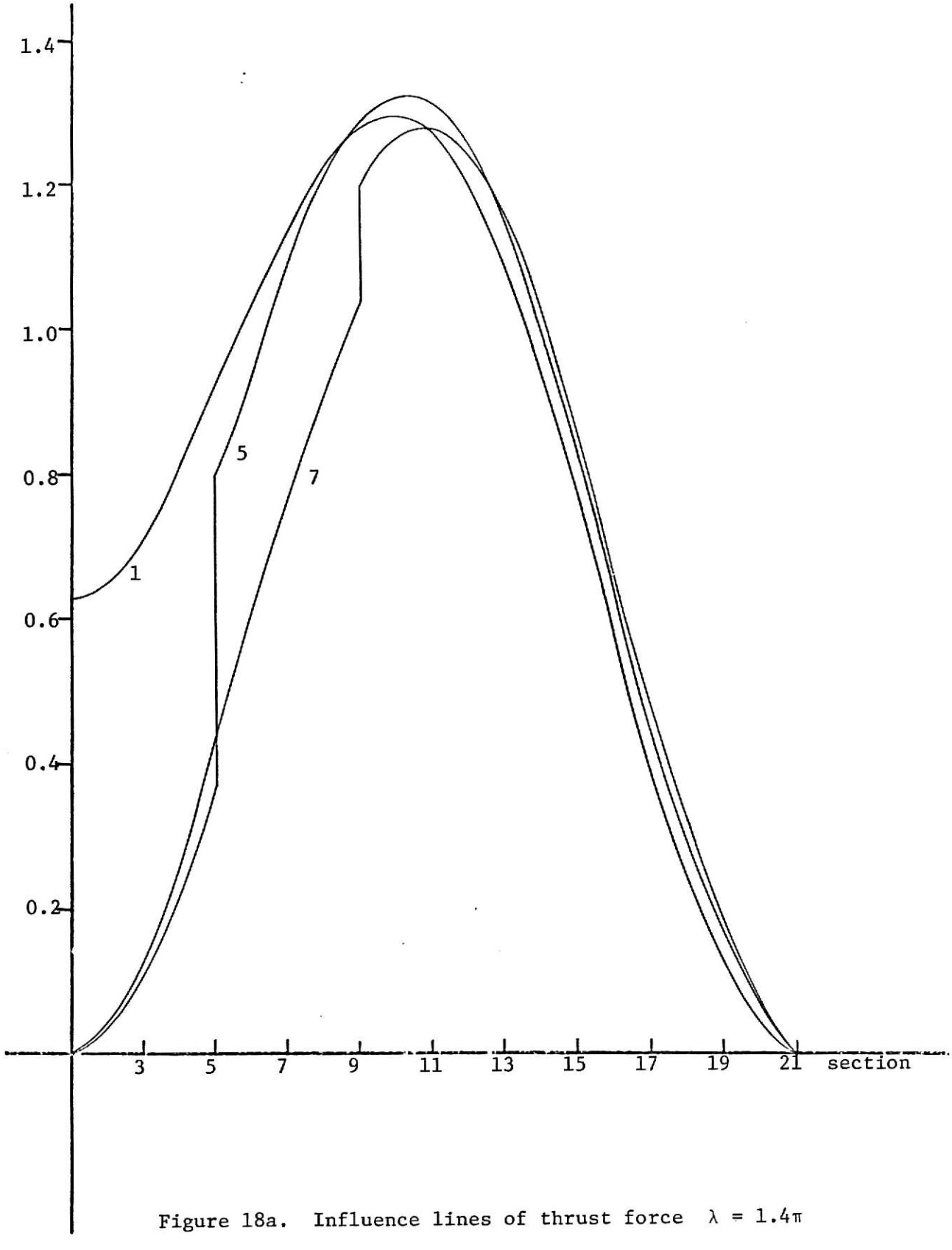

Figure 18a. Influence lines of thrust force $\lambda = 1.4\pi$

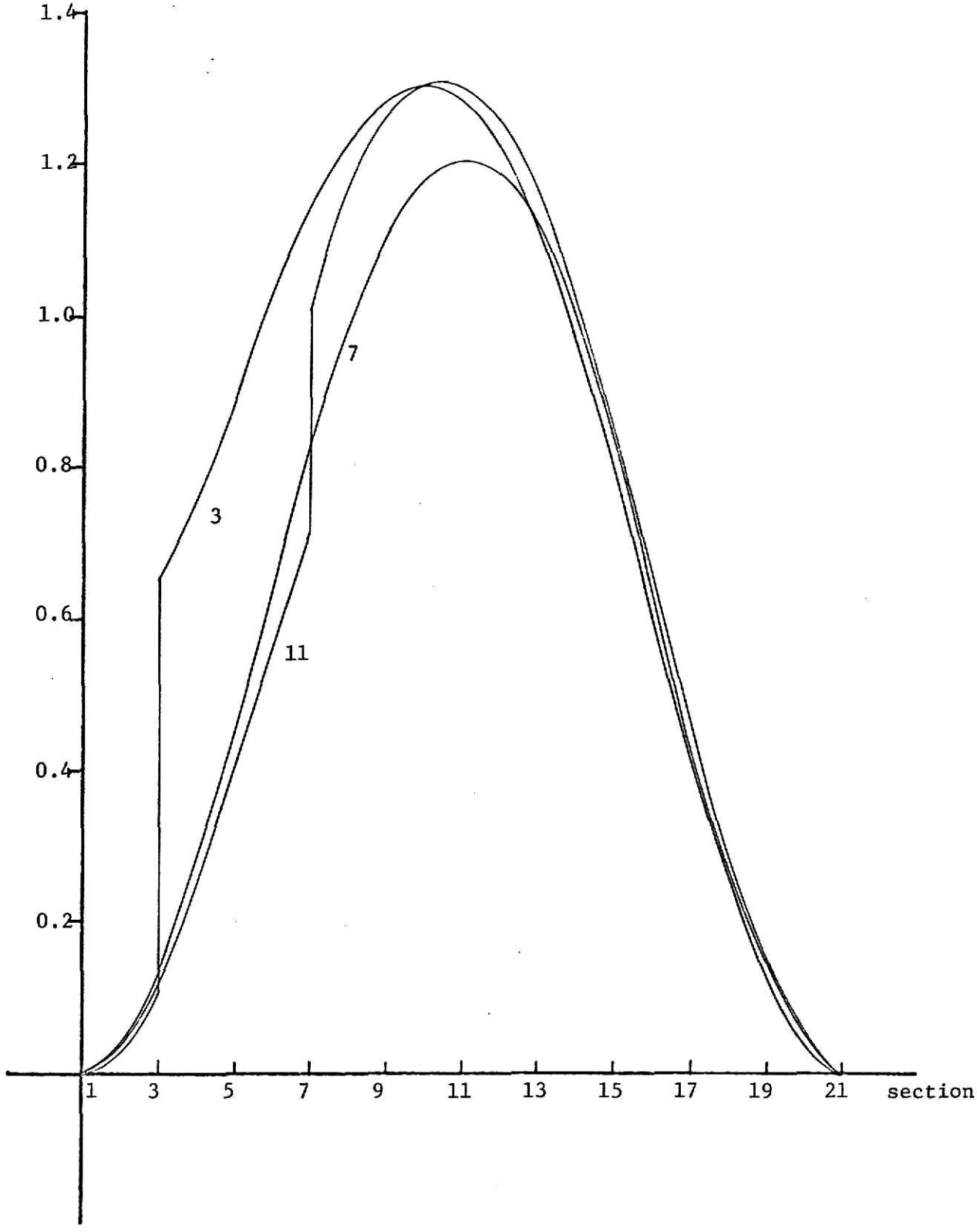

Figure 18b. Influence lines of thrust force $\lambda = 1.4\pi$

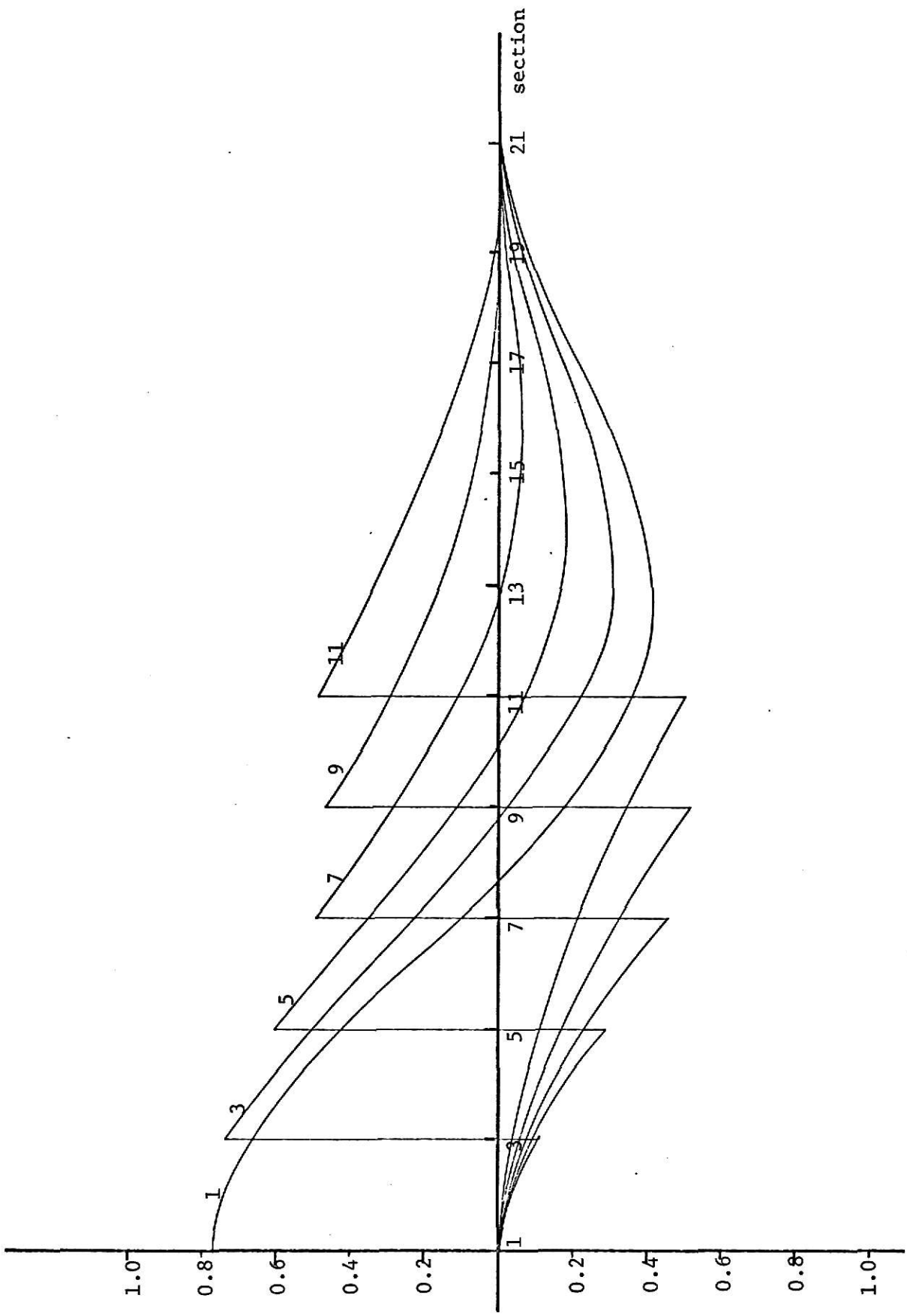

Figure 19. Influence lines of transversal shear $\lambda = 0.\pi$

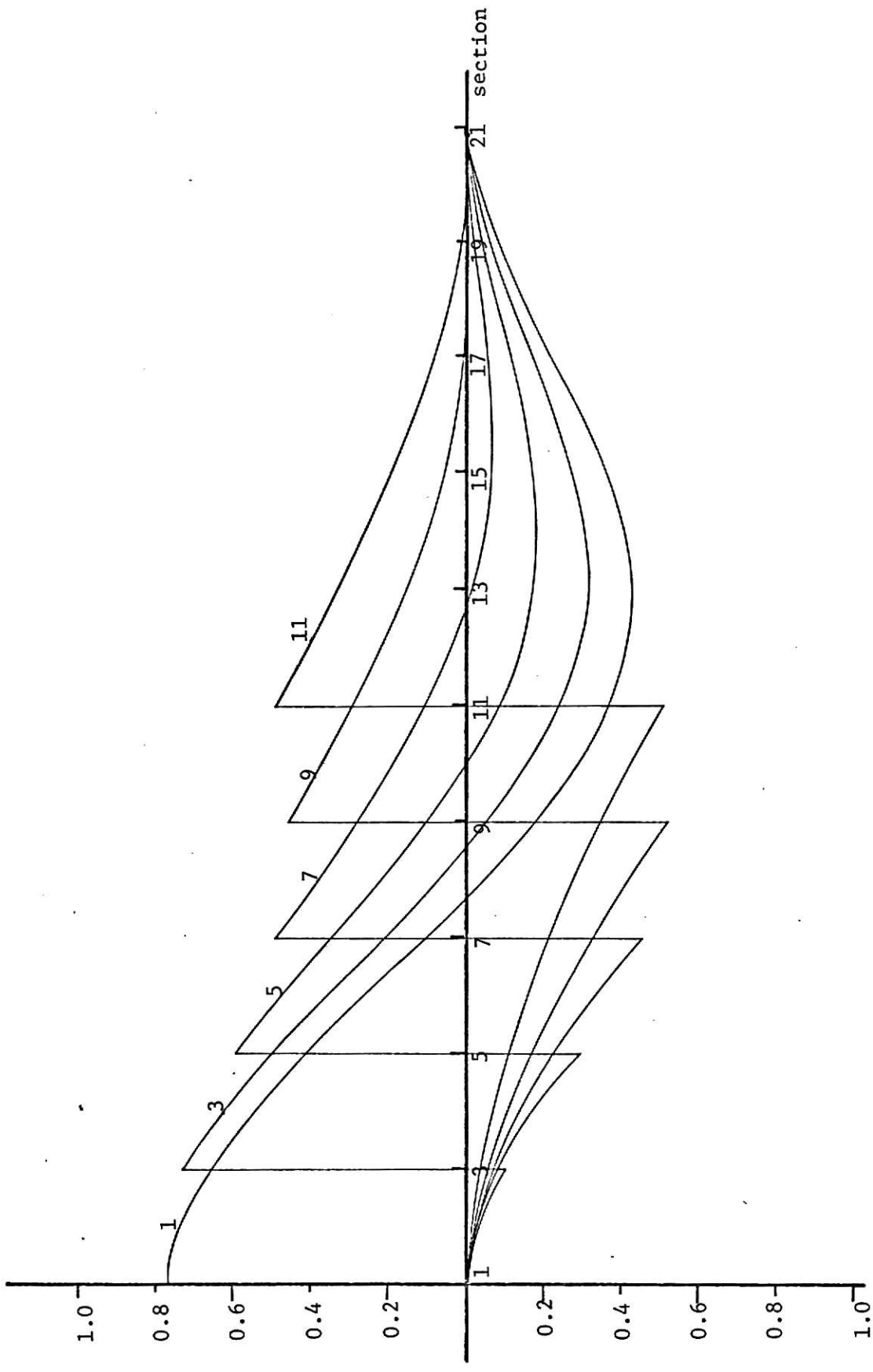

Figure 20. Influence lines of transversal shear $\lambda = 0.4\pi$

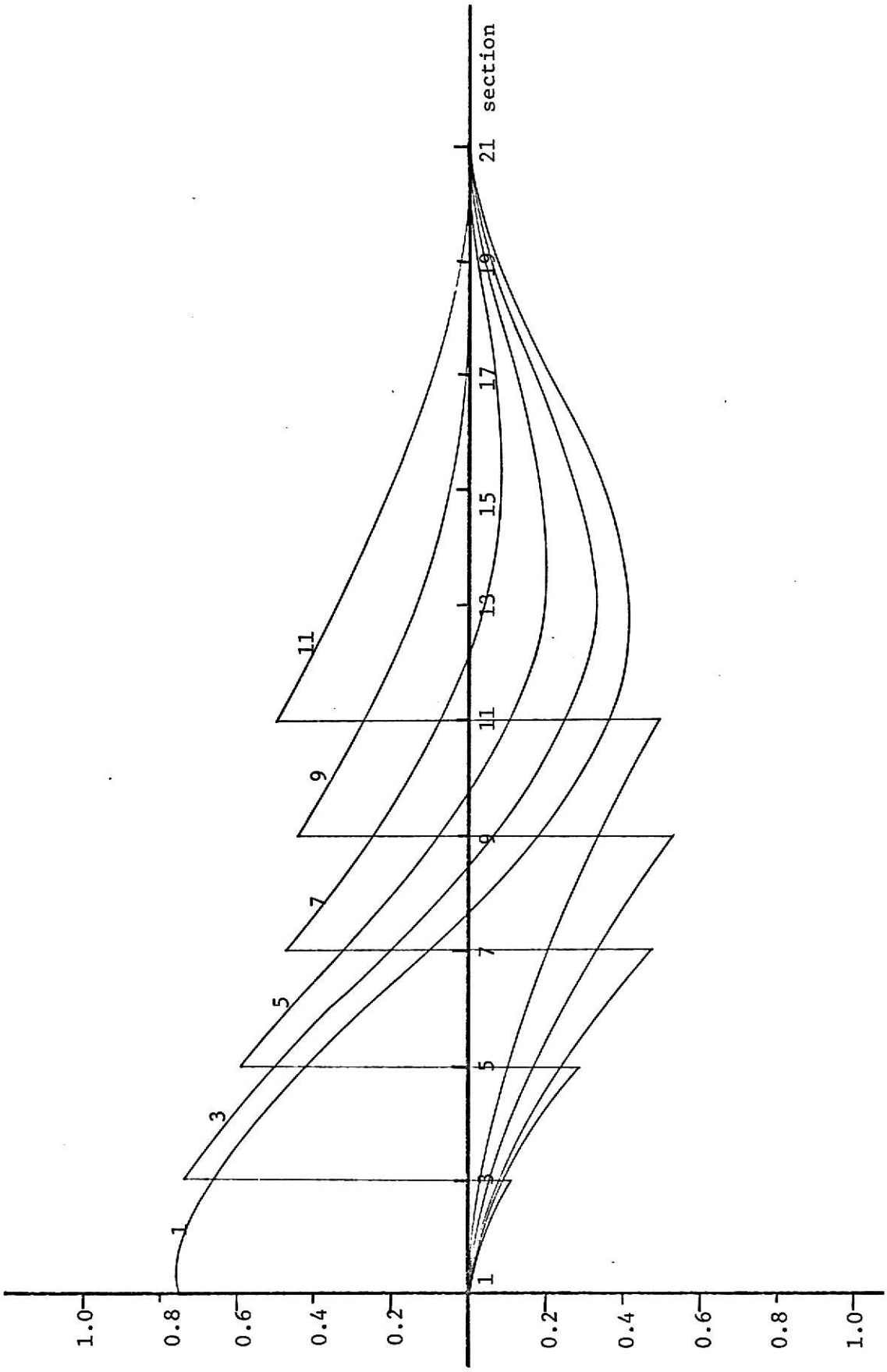

Figure 21. Influence lines of transversal force $\lambda = 0.8\pi$

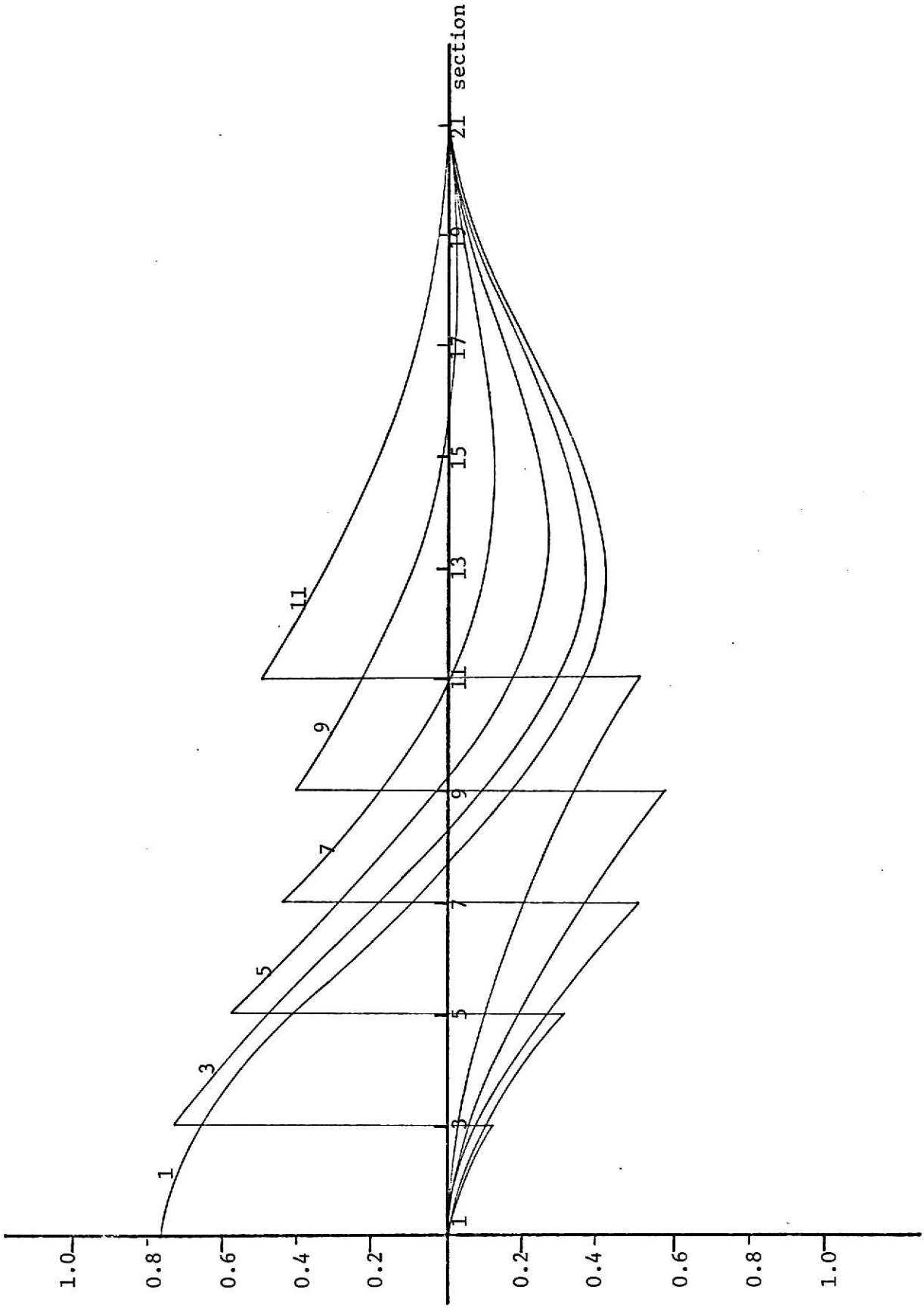

Figure 22. Influence lines of transversal force $\lambda = 1.4\pi$

STRESS ANALYSIS OF FLEXIBLE-INEXTENSIBLE ARCH WITH VARIABLE CROSS SECTION

by

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1970

In this report, the stress analysis of a fixed end arch with variable cross-section is investigated. Deflection theory, which takes the geometry of the deformed arch axis into consideration, is used to analyze the problem.

The governing differential equation is nonlinear. The technique of linearization is employed by introducing an assumed flexibility parameter, which is related to the horizontal arch reaction. The principle of superposition is then applicable. The influence lines or Green's functions for the generalized forces acting in the arch can be constructed for a given value of flexibility parameter. The critical loading condition and corresponding forces for a typical section in the arch can be determined directly from the set of influence lines for an assumed flexibility parameter. The horizontal arch reaction, which is obtained by applying the constraint condition of immovable ends, is a function of the flexibility parameter can be determined by graphical method which requires the equal values of the assumed and computed flexibility parameters. Then an interpolation technique is employed to determine the actual critical forces in a section of the arch corresponding to the actual flexibility parameter.

A numerical example is given as a demonstration of the usage of the method presented. Also the comparison is made for the critical forces obtained by the elastic theory and the deflection theory.