1949

Relaxation method applied to torsion, July 18, 1949

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Recommended Citation
Chang, F. K., "Relaxation method applied to torsion, July 18, 1949" (1949). Fritz Laboratory Reports. Paper 1457.
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Relaxation Method Applied To Torsion

![Graphs](image)

Formulas for Residuals:

(A) Regular star: (Fig.1.) \( R_0 = \phi_1 + \phi_2 + \phi_3 + \phi_4 + 250 - 4 \phi_o \)

(B) One unequal leg at \( \phi_i \): (Fig. 2.) \( R_0 = (II)_{s=A1} \phi_4 + (III)_{s=A2} + 250 - [(I)_{s=A1} + 2] \phi_0 \)

(C) Two unequal legs at \( \phi_i \& \phi_3 \): (Fig. 3.) \( R_0 = (II)_{s=A1} \phi_4 + (III)_{s=A3} \phi_4 + 250 - [(I)_{s=A1} + (II)_{s=A3}] \phi_o \)

Relaxation of Residuals:

(A) Regular star (Fig.1.)

If change \( \phi_o \) by an amount \( m \)

Then \( R_0 \) should be changed by \(-4m\)

\( R_1, R_2, R_3 \) and \( R_4 \) changed by \(+m\).

(B) Irregular star, one unequal leg. (Fig. 2.)

All the same except that changes in \( R_0 \) due to the changes in \( \phi_0 \) or \( \phi_1 \) are different.

(i) If change \( \phi_0 \) by \( m \), \( R_o \) should be changed by \(-[(I)_{s=A1} + 2] m \)

(ii) If change \( \phi_1 \) by \( m \), \( R_0 \) should be changed by \(+[(II)_{s=A1}] m \)

(C) Irregular star, two unequal leg (Fig. 3.)

All the same except that changes in \( R_0 \) due to the changes in \( \phi_0, \phi_2 \) or \( \phi_4 \) are different.

(i) If change \( \phi_0 \) by \( m \), \( R_0 \) should be changed by \(-[(I)_{s=A1} + (II)_{s=A3}] m \)

(ii) If change \( \phi_2 \) by \( m \), \( R_0 \) should be changed by \(+[(II)_{s=A1}] m \)

(iii) If change \( \phi_4 \) by \( m \), \( R_0 \) should be changed by \(+[(II)_{s=A3}] m \)
Block relaxation operators:

Rule: All points like a, having an alteration to the residual of -3 are connected directly to 3 points that remain undisplaced, whilst all pts like b, having a residual alteration of -2, are connected directly to 2 points that remain undisplaced. Of the points that do not move, at any one such pt there is an alteration to the residual of +1 for each direct connection from that point to a point that is being displaced.

Techniques with Symmetry:

Notes:
1. The constant \( \frac{250}{3} \) in the first 3 formulas may be of different values for different cases.
2. All \( \phi \)-values along the boundary equal zero.
3. \((II)_{seal}\), for example, means the value in column (II) of the table on p. 34 "NUMERICAL SOLUTION OF LAPLACES & POISSONS EQUATIONS" corresponding \( S \) value equal to A1. A1 is the ratio of unequal leg to full leg.
(1) Improved Points for 02

\[ x = y \times (a + b) \]

(2) Improved Points for 02

\[ x = y \times (c + d) \]

(3) Choice of Improved:

Shading from pt A
from right to left in order of:
from top to the letter pt
from bottom to the letter pt

[Table and diagrams]

[Signature]

Investigating in Tables

K. E K. K.