DISCUSSION

Simple Equations for Effective Length Factors

Paper by PIERRE DUMONTEIL
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Discussion by **William E. Moore II**

The approximate solutions for K-factor in Pierre Dumonteil's paper will assist engineers in programming both spreadsheet and general language column solutions.

While the general equation for K-factor is rapidly solved by Newton's Method of Successive Approximations, the discontinuity caused by $\text{Tan}(\pi / K)$ being infinite when $K = 2$ interferes with the solution if the initial estimate of K is on the wrong side of 2. This engineer derived a simple method of estimating K which works but lacks the accuracy or simplicity of the solution in the *Engineering Journal*.

For those interested, Newton's Method for the sway case is:

$$x_i = x - \frac{f(x)}{f'(x)} = x - \frac{[Ax^2 - 36]\text{Tan}\,(x) - 6Bx}{[Ax^2 - 36]\text{Sec}^2(x) + 2Ax\text{Tan}(x) - 6B}$$

and for the non-sway case is:

$$x_i = x - \frac{[Ax^3 - 2Bx^2\text{Cot}(x) + 2Bx - 4x + 8\text{Tan}(x/2}{3Ax^2 - 4Bx\text{Cot}(x) + 2Bx^2 Csc^2(x) + \text{Tan}^2(x/2)}$$

where

x_i = Improved value of $x = \pi / K$
x = Estmated value of $x = \pi / K$
$A = Gt \times Gb$ = (Stiffness Top) $\times$ (Stiffness Bottom)
$B = Gt + Gb$ = (Stiffness Top) + (Stiffness Bottom)

The iteration will close to any reasonable degree of accuracy very rapidly.

CLOSURE BY PIERRE DUMONTEIL

The author wishes to thank Mr. Moore for pointing out that, should a mathematically exact solution be required, it can be calculated by Newton's method. The author has found that using the approximate K factor as a starting value gives a very rapid convergence.

The approximate formulae are obviously more convenient for spreadsheet and programmable calculator use.