Roark's Formulas for Stress and Strain (6th Edition)

Platform: Windows
Requires Mathcad 3.1 or higher, CD-ROM reader
Available on CD-ROM only
Available for ground shipment

This Electronic Book offers the complete version of Roark's Formulas for Stress and Strain (6th Edition) published by McGraw-Hill. It includes all 37 tables of formulas, 1,000 design cases covering straight beams and bars, curved beams, plates and shells, and more than 75 worked-out sample problems. For example, you can determine the stress, shear and deflection of an elastic beam with multiple loadings. Or, find the shear forces that occur along the length of a cylindrical shell that is subjected to an intermediate radial load. Whatever the problem, you'll find thousands of standard engineering formulas and hundreds of plots that can easily be changed to address your specific need. Mathcad's "live" math environment automatically recalculates equations and redraws graphs as you change variables so you can see results instantly.

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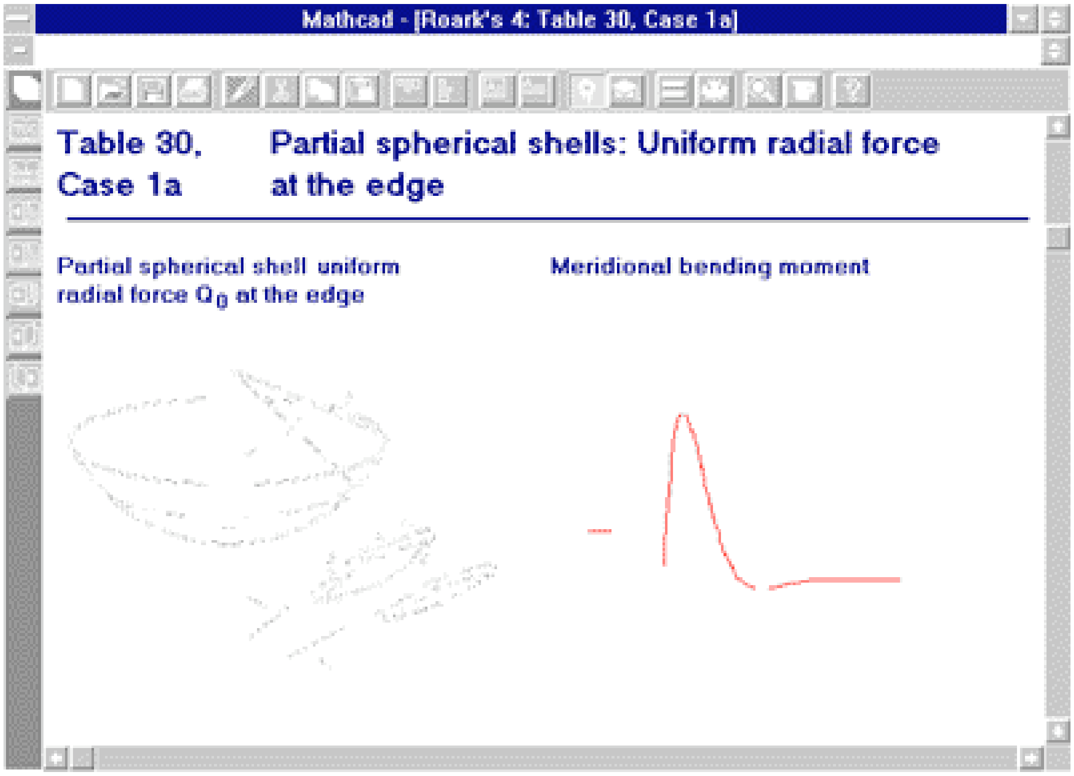

A "live" equation helps calculate uniform radial force on a partial spherical shell. The results can easily be seen in a graph.

Topics include: Moments of Inertia, Plastic Section Moduli, Areas, Stress, Force and Deflection Calculations, Stress, Strain and Deformation for Axisymmetric and Eccentric Loading, Nonisotropic Material Stress Analysis, Combined and Torsional Loading, Combined Stress Formulas, Stress Concentration, Collapse Loads, and much more.

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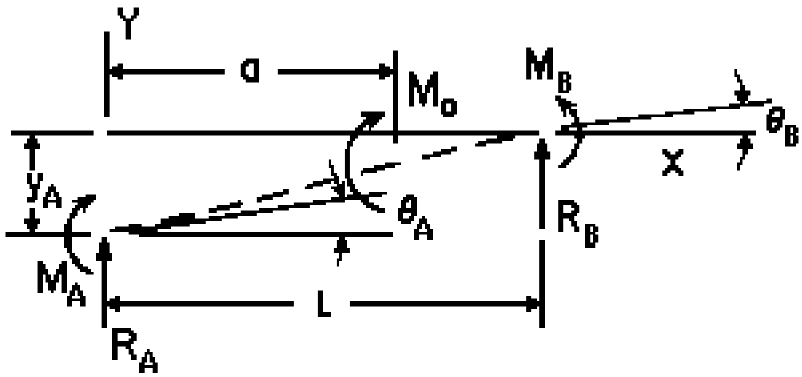
Table 3, Case 3d: Concentrated intermediate moment; left end fixed, right end fixed

(Table 3: Shear, moment, slope and deflection formulas for elastic straight beams)

Concentrated intermediate moment



Left end fixed, right end fixed

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Enter dimensions, properties and loading:

Before progressing further, calculate the moment of inertia (I) for your cross section by flipping to Table 1. Enter the computed value below:

Area moment of inertia: $I \equiv 917.5 \cdot in^4$

Length of beam: $L \equiv 30 \cdot ft$

Distance from left edge to load: $a \equiv 10 \cdot ft$

Modulus of elasticity: $E \equiv 30 \cdot 10^6 \cdot \frac{lbf}{in^2}$

Applied couple: $M_0 \equiv 200000 \cdot lbf \cdot ft$

Boundary values:

The following specify the reaction forces (R), moments (M), slopes (q) and deflections (y) at the left and right ends of the beam (denoted as A and B, respectively).

At the left end of the beam (fixed):

$$R_A := \frac{-6 \cdot M_0 \cdot a}{L^3} \cdot (L - a) \qquad R_A = -8.889 \cdot 10^3 \cdot lbf$$

$$M_A := -\frac{M_0}{L^2} \cdot \left(L^2 - 4 \cdot a \cdot L + 3 \cdot a^2\right) \qquad M_A = 0 \cdot lbf \cdot ft$$

$$\theta_A := 0 \cdot deg \qquad y_A := 0 \cdot in$$

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At the right end of the beam (fixed):

$R_B := -R_A$

$M_B := \frac{M_0}{L^2}\cdot\left(3\cdot a^2 - 2\cdot a\cdot L\right)$ $\qquad$ $M_B = -6.667\cdot10^4$ lbf ft

$\theta_B := 0\cdot deg$ $\qquad$ $y_B := 0\cdot in$

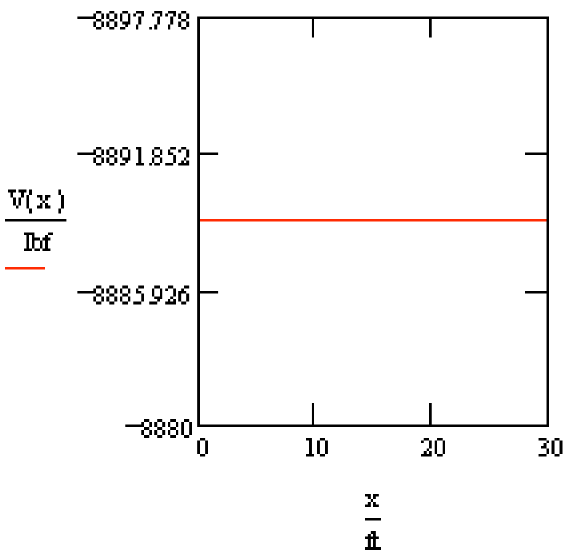
General formulas and graphs for transverse shear, bending moment, slope and deflection as a function of x:

$x := 0\cdot L, .01\cdot L .. L$ $\qquad$ x ranges from 0 to L, the length of the beam.

$x_1 := 15\cdot ft$ $\qquad$ Define a point along the length of the beam.

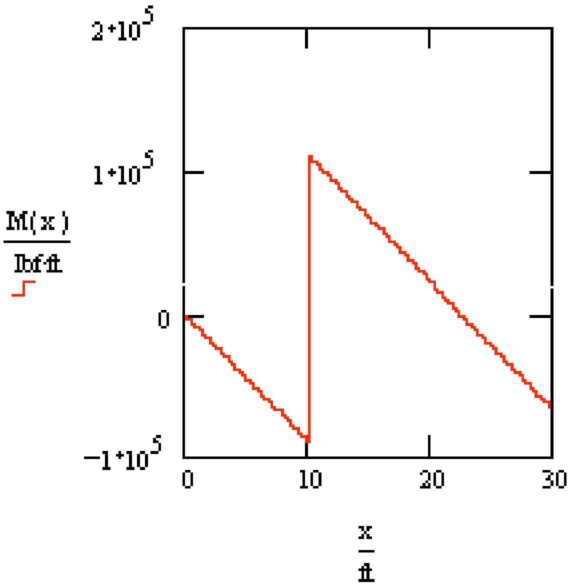
Transverse shear:

$V(x) := R_A$ $\qquad$ $V(x_1) = -8.889\cdot10^3$ lbf



Bending moment:

$$M(x) := M_A + R_A \cdot x + M_0 \cdot (x > a) \qquad M(x_1) = 6.667 \cdot 10^4 \cdot lbf\,ft$$



Slope:

$$\theta(x) := \theta_A + \frac{M_A \cdot x}{E \cdot I} + \frac{R_A \cdot x^2}{2 \cdot E \cdot I} + \frac{M_0}{E \cdot I} \cdot (x - a) \cdot (x > a) \qquad \theta(x_1) = 0 \cdot deg$$

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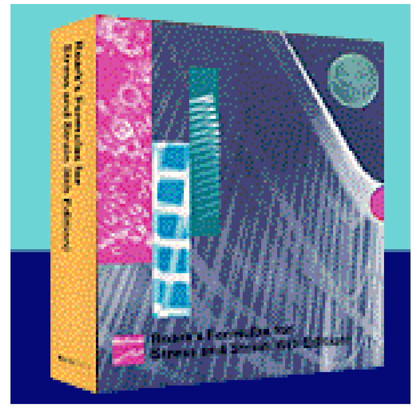
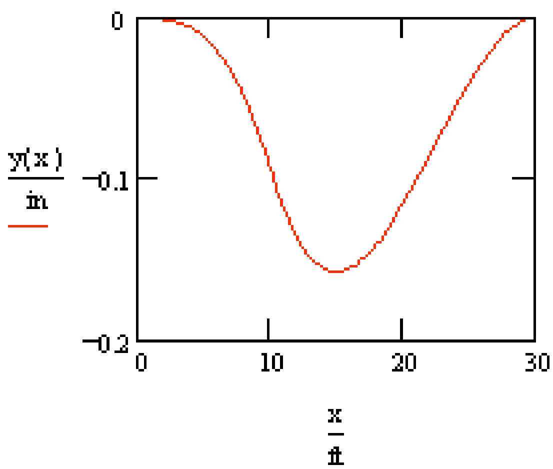


Deflection:

$$y(x) := y_A + \theta_A \cdot x + \frac{M_A \cdot x^2}{2 \cdot E \cdot I} + \frac{R_A \cdot x^3}{6 \cdot E \cdot I} + \frac{M_0}{2 \cdot E \cdot I} \cdot (x - a)^2 \cdot (x > a) \qquad y(x_1) = -0.157 \cdot in$$



Selected maximum values of moments and deformations:

Note: The signs in this section correspond to direction. The subscripts **maxpos/neg** refer to the maximum positive or negative value for the given parameters.

Just right of x = a,

$$M_{maxpos} := \frac{M_0}{L^3} \cdot \left(4 \cdot a \cdot L^2 - 9 \cdot a^2 \cdot L + 6 \cdot a^3\right) \qquad M_{maxpos} = 1.111 \cdot 10^5 \cdot lbf \cdot ft$$

Just left of x = a,

$$M_{maxneg} := \frac{M_0}{L^3} \cdot \left(4 \cdot a \cdot L^2 - 9 \cdot a^2 \cdot L + 6 \cdot a^3 - L^3\right) \qquad M_{maxneg} = -8.889 \cdot 10^4 \cdot lbf \cdot ft$$

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At x = $\frac{L}{3 \cdot a} \cdot (3 \cdot a - L) = 0 \cdot ft$

with no positive deflection if a < L/3,

$$y_{maxpos} := \frac{2 \cdot M_A^{\,3}}{3 \cdot R_A^{\,2} \cdot E \cdot I} \qquad y_{maxpos} = 0 \cdot in$$

Note that if a < L/3, the displayed values of x and ymaxpos will be negative and invalid.

The subscripts **(p/n)maxval** refer to the maximum magnitude of the most positive or negative value for this case.

When a = L,

$$M_{pmaxval} := M_0 \qquad M_{pmaxval} = 2 \cdot 10^5 \cdot lbf\ ft$$

When a = 0,

$$M_{nmaxval} := -M_0 \qquad M_{nmaxval} = -2 \cdot 10^5 \cdot lbf\ ft$$

At x = 0.565 L and when a = 0.767 L,

$$y_{pmaxval} := 0.01617 \cdot \frac{M_0 \cdot L^2}{E \cdot I} \qquad y_{pmaxval} = 0.183 \cdot in$$

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