

Beam Deflection Boundary Value Example

Beam info:

$$\begin{array}{ll} L := 10 & \text{length} \\ w := 100 & \text{distributed load} \end{array} \quad \begin{array}{ll} E := 30 \cdot 10^6 & \text{modulus of Elasticity} \\ I := 5 \cdot 10^{-3} & \text{cross-section area moment} \end{array}$$

ODE:

$$\frac{d^2}{dx^2}y = \frac{M(x)}{EI} = \frac{w \cdot x}{2 \cdot E \cdot I} (L - x)$$

$$\text{BC's:} \quad y(0) = 0 \quad y(L) = 0$$

Theoretical solution (from Solid Mechanics book):

$$y_t(x) := \frac{-w}{24 \cdot E \cdot I} \cdot (x^4 - 2 \cdot L \cdot x^3 + L^3 \cdot x)$$

MathCAD solution:

Given

$$\frac{d^2}{dx^2}y(x) = \frac{w \cdot x}{2 \cdot E \cdot I} (L - x)$$

$$y(0) = 0 \quad y(L) = 0$$

y := Odesolve(x, L)

x := 0, 0.01 .. L

