

Advanced Mechanics of Materials (C131)
Computer Project (Due on Friday after Thanksgiving holiday)

Consider an one-dimensional bar problem,

$$\frac{d}{dx} \left(EA \frac{du}{dx} \right) = -q(x), \quad 0 < x < L \quad (1)$$

where $q(x) = cx^2$ and the associated boundary conditions are

$$u(0) = 0, \quad \text{and} \quad EA \frac{du}{dx} \Big|_{x=L} = P. \quad (2)$$

1. Find the exact solution;
2. Find the one-term and two-term Rayleigh-Ritz solutions and compare them with the exact solution;
3. Find the finite element solutions for 2-element, 4-element, and 16-element discretizations, and compare them with the exact solution;

Assume that FEM discretization is uniform, and the following data may be used in computation:

1. $EA = 1.0$;
2. $c = 1.0$;
3. $L = 1.0$;
4. $P = 1.0$;