

HOMEWORK SET # 3
ME/AE 6212 Advanced Finite Element Analysis

Solve the following two problems using **fem1d** (book code).

Need a summary of numerical results along with output. The summary should follow the problem statement.

1. For one-dimensional bar (fixed at $x=0$ and free at $x=L$), determine the natural frequencies of longitudinal vibration using four and eight elements of equal length. (20 points)

$$E = 30 \times 10^6 \text{ psi}, \quad \rho = 0.00073 \frac{\text{lbs}^2}{\text{in}^4}, \quad A = 1 \text{ in}^2, \quad L = 100 \text{ in}.$$

Compare your results with the exact solution

$$\omega_n = \left(\frac{n\pi}{2L} \right) \sqrt{\frac{E}{\rho}}; \quad n = 1, 3, 5, \dots$$

2. For a simply supported beam, determine the natural frequencies of transverse vibration using four and eight elements of equal length. Assume the unit height and unit width. Use Euler-Bernoulli beam element.

(20 points)

$$E = 30 \times 10^6 \text{ psi}, \quad \rho = 0.00073 \frac{\text{lbs}^2}{\text{in}^4}, \quad L = 100 \text{ in}.$$

Compare your results with the exact solution

$$\omega_n = \left(\frac{n\pi}{L} \right)^2 \sqrt{\frac{EI}{\rho A}}; \quad n = 1, 2, \dots$$