

ME30180: Finite Element Method

Homework-1

Due Date: August 9, 2024

1. Obtain the vector \vec{a}' in the rotated coordinate system $(x' - y')$ shown in Figure below in terms of the original vector \vec{a} .

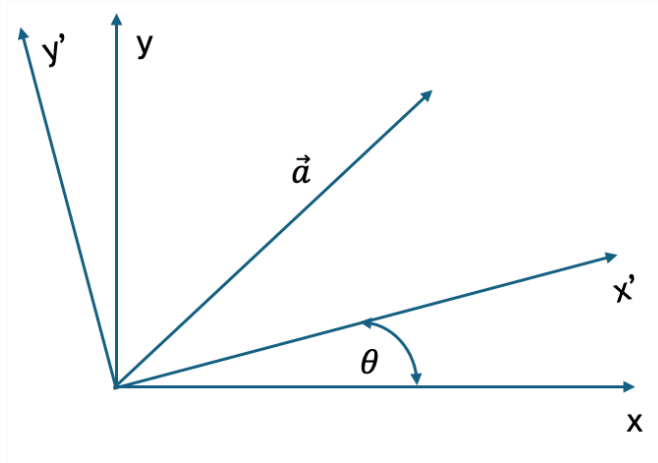


Figure 1: Rotated co-ordinate System

2. Obtain the differential equation for the bar shown in the figure below. The cross-sectional area at the left is A_0 and on the right is A_1 . The Young's modulus for the bar material is E .

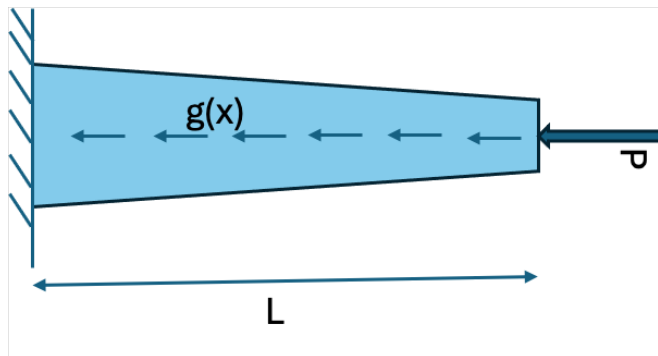


Figure 2: Spring System

3. Invert the matrix given in figure-3 using the Adjoint Method.
4. Invert the matrix given in figure-3 using the row reduction method.

$$\begin{bmatrix} -1 & 3 & -2 \\ 2 & -4 & 2 \\ 0 & 4 & 1 \end{bmatrix}$$

Figure 3: Matrix for Q: 3-6

5. Write a computer program (MATLAB/PYTHON/Julia/C/C++/any other language) to compute the inverse of the matrix given in figure-3 using the adjoint and row reduction method.
6. Compute the eigenvalues and eigenvectors of the matrix given in figure-3.
7. Using the direct stiffness method, formulate the stiffness matrix and system of equations for the spring system shown in Fig. 1

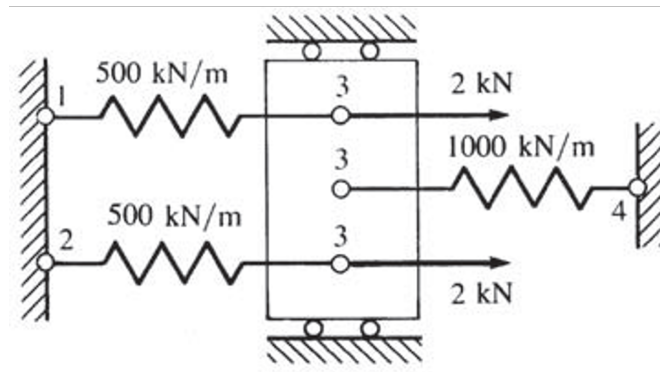


Figure 4: Spring System

8. Write a computer program (MATLAB/PYTHON/Julia/C/C++/any other language) to compute the solution of the Q-7.