Tutorial 9: Dynamic analysis

Answer all questions        Total marks: 25

1. What are essential characteristics of a dynamic system?

   - Equation of motion is used to characterize the response mathematically.
   - Dynamic system need to be modelled.
   - Essential features of a Dynamic System
     - M - (1) Mass - representing the inertia characteristics
     - K - (2) Stiffness - representing the restoring force capacity
     - C - (3) Dampening - representing the frictional characteristics and energy loss in the system
     - F(t) - (4) An excitation force, representing the external force (if any)

2. Determine the influence co-efficient matrix for the multi-degrees-of-freedom system shown in the below figure:

   ![Diagram of a multi-degrees-of-freedom system](image)

   \[
   \text{Influence Co-efficient Matrix } \delta = \begin{bmatrix}
   6 & 5 & 3 \\
   5 & 7 & 4 \\
   3 & 4 & 6
   \end{bmatrix}
   \]

3. Determine the fundamental frequency of the system whose \([M]\) and influence coefficient matrix \(\delta\) are given as below:

   \[
   M = \begin{bmatrix}
   60 & 0 & 0 \\
   0 & 100 & 0 \\
   0 & 0 & 80
   \end{bmatrix},
   \delta = \begin{bmatrix}
   6 & 5 & 3 \\
   5 & 7 & 4 \\
   3 & 4 & 6
   \end{bmatrix}
   \]

4. Evaluate the frequency and mode shape for the MDOF system using Influence coefficient method. Use Dunkerley's method to evaluate natural frequency of the system.

   ![Diagram of a MDOF system](image)

   \[m = 35 \text{ kN}; \ K = 1000 \text{ kN/m}\]

5. Evaluate the fundamental frequency and mode shape for the MDOF system using Stodola method.

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