THESIS INFORMATION

Title: **Nonlinear Static and Dynamic Analysis of Planar Steel Frames using Co-rotational Element**

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This dissertation presents a new beam-column element for large-displacement inelastic analysis of planar steel frames with semi-rigid beam-to-column connections under static and dynamic loads. The element stiffness matrix is developed in a corotational context based on an approximate seventh-order polynomial solution to the governing differential equations of a planar beam-column element subjected to end axial forces and bending moments. The second-order effect of axial force on bending stiffness and the change in axial force caused by end rotations of the element are accurately incorporated in the element formulation. Both refined plastic-hinge and fiber-hinge methods are used to simulate the material nonlinearity in lumped inelastic concept while the rotational springs with nonlinear moment – rotation relationship are used to model the flexibility and the hysteresis loop behavior of the beam-to-column connections. The arc-length combined with minimum residual displacement methods are used to solve the nonlinear equilibrium equations of the system under the static loads. The average acceleration Newmark combined with iterative Newton-Raphson methods are used to solve the equations of motion of the framed structure under dynamic loads. A computer program is implemented in the MATLAB programing language based on the above-mentioned algorithm to automate the analysis process. Nonlinear analysis results of a variety of numerical examples using the minimum number of elemenets per member are compared with those of existing studies and with nonlinear finite element analyses using ANSYS and ABAQUS to verify the reliability and accuracy of the proposed method.

Scientific supervisors **PhD. Student**

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