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Modal Analysis of Small Frames using High Order Timoshenko Beams

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Abstract : In this paper, we consider the modal analysis of small frames. Firstly, we construct the 3D model using H8 elements and find the natural frequencies of the frame focusing our attention on the modes in the XY plane. Secondly, we construct the 2D model (plane stress model) using Q4 elements. We concluded that the results of both models are very close to each other's. Then we formulate the stiffness matrix and the mass matrix of the 3-noded Timoshenko beam that is well suited for thick and short beams like in our case. Finally, we model the corners where the horizontal and vertical bar meet with a special matrix. The results of our new model (3-noded Timoshenko beam for the horizontal and vertical bars and a special element for the corners based on the Q4 elements) are very satisfying when performing the modal analysis.

Keywords : corner element, high-order Timoshenko beam, Guyan reduction, modal analysis of frames,rigid link, shear locking, and short beams
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