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EFFICIENT LOCKING-FREE CURVED BEAM ELEMENTS USING MIXED FORMULATION

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This study is dedicated to develop two efficient curved beam elements by using mixed formulation. It is worth mentioning that due to use of mixed interpolation of strain fields, the element is free of shear and membrane locking. Two elements including three and four node beam elements were formulated separately. Since a mixed interpolation of strains is employed, some essential tying points are used for this interpolation for each element. The selected points are the same as the Gauss integration points. It is obvious that the elements can be employed for tapered members. The tensorial form of the formulations is used to summarize them. In addition, the proposed elements are utilized for linear bending analysis of the Functionally Graded Beams (FGB). For this reason, a power function is used for variation of elastic modulus through the height of the beam while the Poisson's ratio is assumed to be constant. A convergence study is done to show high accuracy of the proposed elements. In addition, some other well-known benchmarks are solved to validate the formulation. Findings indicated the high performance and capability of the proposed elements.

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