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Coupling of *h* and *p* finite elements: Application to free vibration analysis of plates with curvilinear plan-forms

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Abstract :

This paper presents a method for coupling isoparametric cubic quadrilateral *h*-elements and straight sided serendipity quadrilateral *p*-elements. The *p*-elements are used to model the interior of the domain while the *h*-elements are used to describe accurately the curved boundaries. At a common side shared by a *p*-element and an arbitrary number of *h*-elements, the field variables are minimized in the least square sense with respect to the degrees-of-freedom of the *h*-elements. This leads to a set of equations which relate the degrees-of-freedom of the coupled elements on the shared side. The method is applied to the calculation of frequencies for plates with curvilinear plan-forms. The effects of shear deformation and rotary inertia are taken into account. The frequencies are obtained for a sectorial plate with simply supported radial edges and free circular edge, an annular sectorial plate with simply supported radial edges and clamped circular edges, and a circular plate with one concentric ring support. Furthermore, new accurate frequencies are given for a fully clamped square plate with a corner cut-out. Constant meshes are used and convergence is sought by increasing progressively the degree *p* of the interpolating polynomial. The fast convergence and high accuracy of the method are validated through convergence and comparison studies.

Keywords : Coupling of h and p finite elements; Plate; Curvilinear plan-form; First-order shear deformation plate theory;Free vibration; Least squares

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