

**A Highly Accurate and Efficient Separation Variable High-order Finite Element Method and
Its Application to Thickness-shear Vibration of Rectangular Crystal Plates**

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A separation variable high-order finite element method (SVHFEM) was proposed by writing the variables inside the element of a differential quadrature finite element method (DQFEM) into separation variables form. The writing of a variable into separation variable form does not obviously reduce the accuracy of approximating the variable but can greatly reduce the number of grid points used to interpolate the variable. The retaining of the variables along the boundary of the element makes the element of the SVHFEM as flexible as normal high-order finite elements. Therefore, the SVHFEM is capable of providing highly accurate results with only a few grid points and high efficiency, and is also as flexible as normal finite element method. The application the SVHFEM to thickness-shear vibration of a rectangular crystal plate showed that the SVHFEM was a promising method for solid mechanics problems that had huge computational cost and require high accuracy.

Keywords: Separation variable, High-order finite element method, Thickness-shear vibration, Crystal plates, High accuracy, High efficiency