

Matched interface and boundary method for free vibration analysis of triangular and quadrilateral membranes

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Abstract

The method of matched interface and boundary (MIB) is introduced to analyze free vibration of triangular and quadrilateral membranes including skew and trapezoidal membranes. Two distinct schemes-on-interface and off-interface schemes are used to deal with the possible topological relations between edges of membranes and the Cartesian mesh lines. MIB procedures for handling these two schemes are established. By using MIB method, the computational domains near the edges of these irregular membranes can be extended, so that the standard high order-central finite difference (HO-CFD) method can be applied near the edges, which results in that irregular shaped membranes can be solved by HO-CFD. Various examples are selected to illustrate the accuracy and convergence of the present MIB. Numerical results show that for some of triangular and skew membranes in which on-interface scheme can be used, up to sixth-order convergence rates can be achieved. For other irregular shaped membranes in which off-interface scheme can be used, up to fourth- and over second-order convergence rates can be achieved, which indicates that the present MIB show high order convergence. This is the first time that HO-CFD method has been used to solve these problems and high order convergence has been achieved. The present MIB can also be used to solve other problems with irregular domains.

Keywords: Matched interface and boundary method; high order-central finite difference; irregular shaped membrane