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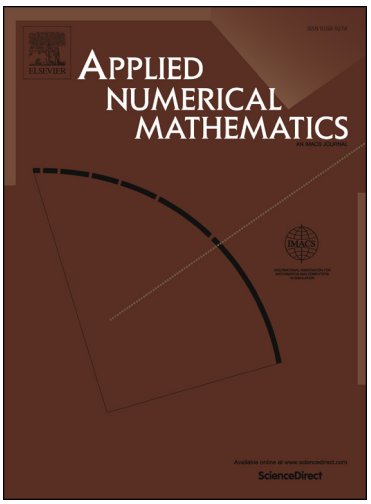

Criteria for hexahedral cell classification

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Abstract

The aim of the paper is to give the numerical criteria for classification of different types of hexahedral cells which can emerge in a three-dimensional structured grid generation. In general, computational grids and their cells have to be nondegenerate, however, in practice, situations arise in which degenerate grids are used and computed. In these cases, to prevent lost of accuracy, special strategies must be chosen both in grid generation and physical phenomenon solution algorithms. To determine which cells need a modification in above strategies, degenerate cells have to be detected. The criteria are suggested for hexahedral cells constructed by a trilinear mapping of the unit cube. All hexahedral cells are divided into nondegenerate and degenerate. Among nondegenerate hexahedral cells, cells exotic in shape are singled out as inadmissible. Degenerate cells are divided into pyramids, prisms and tetrahedrons — types of cells which can be admissible in grid generation and solution algorithms. Inadmissible types of degenerations are also considered. An algorithm for testing three-dimensional structured grids according to suggested criteria is described. Both results of testing and examples of different types of cells are demonstrated. In conclusion, recommendations for structured grid generation with the purpose to exclude undesirable types of cells are given.

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