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Adaptive grid generation based onthe least-squares finite-element method. (English)

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Summary: Approximate solutions of a partial differential equation become inaccurate if they are computed on a fixed grid that is not sufficiently fine in regions of the domain where the variables change rapidly. For time dependent problems, special features of a partial differential equation and their location could change in time as well. Thus, adaptive grid methods are necessary.

In this paper, we develop an adaptive deformation method based on the least-squares finite-element method. A main advantage of this method as compared to the existing deformation method is its ability to generate adaptive grids on domains with moving boundary. It computes the node velocity from a div-curl system according to an error indicator (monitor function), and then moves the nodes to new locations so that the size of the new grid cells can be directly controlled. In this method, the connectivity of the nodes is unchanged if the grid quality is acceptable. Otherwise, various optimization procedures can be applied after node movements to improve grid quality. The grid formed becomes refined in regions where the solution error is large.

MSC:

65M50	Mesh generation, refinement, and adaptive methods for the numerical solution of initial value and initial-boundary value problems involving PDEs	Cited in **1** Review Cited in **9** Documents
35K55	Nonlinear parabolic equations	
65M60	Finite element, Rayleigh-Ritz and Galerkin methods for initial value and initial-boundary value problems involving PDEs	

Keywords:

Least-squares finite elements; Grid deformation; transport equation; numerical examples

Full Text: DOI

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