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A matrix-free implicit iterative solver for compressible flow problems. (English)

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Summary: A procedure for solving nonlinear time-marching problems is presented. The nonsymmetric systems of equations arising from Newton-type linearizations are solved using an iterative strategy based on the generalized minimal residual (GMRES) algorithm. Matrix-free techniques leading to reduction in storage are presented. Incorporation of a linesearch algorithm in the Newton-GMRES scheme is discussed. An automatic time-increment control strategy is developed to increase the stability of the time-marching process. High-speed flow computations demonstrate the effectiveness of these algorithms.

MSC:

76M10 Finite element methods applied to problems in fluid mechanics
76N10 Existence, uniqueness, and regularity theory for compressible fluids and gas dynamics

Keywords:

generalized minimal residual algorithm; time-marching problems; Newton-type linearizations; automatic time-increment control strategy