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An accelerated Newton method for nonlinear materials in structure mechanics and fluid mechanics. (English) Zbl 1432.76166

Radu, Florin Adrian (ed.) et al., Numerical mathematics and advanced applications. ENUMATH 2017. Selected papers based on the presentations at the European conference, Bergen, Norway, September 25–29, 2017. Cham: Springer. Lect. Notes Comput. Sci. Eng. 126, 345-353 (2018).

Summary: We analyze a modified Newton method that was first introduced in [*S. Mandal* et al., Lect. Notes Comput. Sci. Eng. 112, 481–490 (2016; Zbl 1387.76058)]. The basic idea of the acceleration technique is to split the Jacobian $A'(x)$ into a "good part" $A_1'(x)$ and into a troublesome part $A_2'(x)$. This second part is adaptively damped if the convergence rate is bad and fully taken into account close to the solution, such that the solver is a blend between a Picard iteration and the full Newton scheme. We will provide first steps in the analysis of this technique and discuss the effects that accelerate the convergence.

For the entire collection see [Zbl 1411.65009].

MSC:

76M10 Finite element methods applied to problems in fluid mechanics
74S05 Finite element methods applied to problems in solid mechanics
65H10 Numerical computation of solutions to systems of equations
74R10 Brittle fracture
65N30 Finite element, Rayleigh-Ritz and Galerkin methods for boundary value problems involving PDEs
76A05 Non-Newtonian fluids
65N22 Numerical solution of discretized equations for boundary value problems involving PDEs
76A10 Viscoelastic fluids

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