Bécache, E.; **Joly, P.**; **Tsogka, C.**

A new family of mixed finite elements for the linear elastodynamic problem. (English)

Zbl 1032.74049
SIAM J. Numer. Anal. 39, No. 6, 2109-2132 (2002).

The authors develop and analyze a new family of mixed finite elements for velocity-stress formulation of elastodynamics. For both stationary and evolution problems, the convergence of solution in L^2 norm is obtained. These results are valid for any finite element space of order k, and a generalization of these results to three-dimensional case is straightforward. The error estimates obtained for an elliptic problem give the same convergence rate, assuming less regularity of the solution. Convergence is obtained with regularity $H^1(\Omega)$ for the velocity. For the solution of evolution problem, error estimates are given in $C(0,T;H(\mathrm{div}))$, but they require more regularity with respect to time. Related results can be found in [*E. Bécache, P. Joly and C. Tsogka*, C. R. Acad. Sci., Paris, Sér. I, Math. 325, 545-550 (1997; Zbl 0895.73064); SIAM. J. Numer. Anal. 37, 1053-1084 (2000; Zbl 0958.65102) and *J. C. Nédélec*, Numer. Math. 50, 57-81 (1986; Zbl 0625.65107)].

Reviewer: Nicolae Pop (Baia Mare)

MSC:

74S05	Finite element methods applied to problems in solid mechanics
74H15	Numerical approximation of solutions of dynamical problems in solid mechanics
65M12	Stability and convergence of numerical methods for initial value and initial-boundary value problems involving PDEs
65M60	Finite element, Rayleigh-Ritz and Galerkin methods for initial value and initial-boundary value problems involving PDEs
65M15	Error bounds for initial value and initial-boundary value problems involving PDEs

Keywords:

velocity-stress formulation; convergence; error estimates; elliptic problem; regularity; mass lumping; evolution problem

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