On FEM Evaluation in Linear Micropolar Elasticity

Victor A. Eremeyev, Andrzej Skrzat, Feliks Stachowicz, and Anastasia Vinakurava

Faculty of Mechanical Engineering and Aeronautics, Rzeszow University of Technology, al. Powstańców Warszawy 8, 35959 Rzeszów, Poland

veremeyev@prz.edu.pl, askrzat@prz.edu.pl, stafel@prz.edu.pl vinakurava@prz.edu.pl

Abstract: The model of the micropolar continuum introduced more than hundred years ago by Cosserats, Recently it found applications in modelling of micro- and nanostructured solids and fluids such as foams, beam lattices, masonries, granular and porous media such as bones and foams, liquid crystals and magnetic fluids.

Obviously, for engineering analysis one needs effective tool such as finite element approach together with suitable program. Here we discuss the developments in the theory of finite elements calculations for micropolar solids in order to capture the stress behaviour in the vicinity of geometric singularities such as notches or contact areas. The new 8-node hybrid micropolar isoparametric element and its implementation in ABAQUS are discussed. We analyzed few 3D benchmark problems of the micropolar elasticity including the following ones. We present analysis near notches and holes, contact problem of two solids and interaction between a biodegradable implant and a trabecular bone. Comparison of classical and micropolar solutions is carefully discussed. Numerical tests have shown that couple stress appears almost in the vicinity of geometrical singularities, near notches, holes and contact areas.

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