

Numerical Methods for Problems of Nonlinear Elasticity with Large Distortions

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Non-linear elasticity with large displacements and/or strains is a well known and widely studied argument; innumerable papers are found in the literature tackling this topic, ranging from theoretical foundations, constitutive issues, numerical approximations, and so on. Much smaller indeed is the number of papers dealing with non-linear elasticity with large distortions (also known as pre-strains), and even narrower is the number of those about numerical solutions or finite element method for solving such kinds of problems. Here, we shall investigate some numerical approaches to the elastic problems when large distortions are involved. In particular, after a brief review of the notion of distortions, and the related multiplicative decomposition of the deformation gradient into a distorted and elastic part, we shall present the isotropic hyperelastic model for neo-Hookean, incompressible material. Granted for this constitutive model, we shall discuss the effectiveness of different mixed schemes (displacement-pressure, de Voebeke-Hu-Washizu formulation) on solving selected examples, such as the plain strain regime with stepwise distortions field.