

# FIRST-ORDER SYSTEM APPROACHES TO HYPERELASTIC DEFORMATION MODELS

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## **Abstract**

Different first-order system approaches for hyperelastic deformation models are studied using, in addition to the displacement field, quantities like the Piola-Kirchhoff stress tensor, the deformation gradient, as well as its cofactor and determinant, as process variables. We comment on the advantages and disadvantages of these methods in comparison with more standard techniques and discuss their implementation using suitable vertex-, face-, edge- or element-based finite element spaces. Of particular interest is the investigation of robustness for incompressible materials. Finally, numerical comparisons with standard approaches for some illustrative test examples will be presented.