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FINITE ELEMENTS IN NON-LINEAR SOLID MECHANICS – FORMULATIONS AND APPLICATIONS (200 – ADVANCED DISCRETIZATION TECHNIQUES)

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ABSTRACT

It is well known that standard low-order finite elements in solid mechanics exhibit undesirable stiffening effects for nearly incompressible materials as well as for modelling bending dominated deformations. Therefore, much research has been invested to cure the aforementioned stiffening. In particular, a large part of effective concepts against these so-called locking phenomena, e.g. shear and volumetric locking, are based on multi-field variational functionals. It turns out that many formulations developed in recent research show highly satisfactory behaviour regarding deformation and stress fields.

On the one hand, the uniqueness of a solution in nonlinear solid mechanics cannot be required in general, since singular solutions such as bifurcation points might become physically relevant and should be captured by a powerful numerical method. On the other hand, the use of multi-field variational functions introduces additional variables (e.g. the enhanced strain) into the formulation, which enormously increases the complexity of the stability issue and eventually leads to artificial bifurcation points.

The problem is still unsolved. The present mini-symposium aims at gathering new ideas and viewpoints to deal with the stability issue of finite element formulations in non-linear solid mechanics, which show "locking-free" behaviour. Contributions from both, engineers and mathematicians, are highly welcome. Additionally, applications of new finite elements formulations in engineering including biomechanics and metal forming are welcome.