Abstract:
The p-version of the finite element method (p-FEM) performs very well for linear elastic problems. Recently highly non-linear problems, as cold isostatic pressing (CIP) of metal powders (finite deformations and complex constitutive models) have become of interest. These problems require enhancement of p-FEMs to geometrically and physically non-linear capabilities, where good performance is expected, and results should be validated by experimental observations. This task is being performed by designing a set of experimental techniques for a) adoption of a constitutive model that describes qualitatively the experimental observation and b) identification of the material parameters. This talk presents the results of a 3-years project by five different groups in developing a p-FEM simulation tool for CIP processes validated by experimental observation. The p-FEM academic code AdhoC has been extended to incorporate geometrical and physical non-linear constitutive models of evolutionary type. This includes stress computation and consistent linearization of the inelastic model. On the basis of experimental observations (for particular powder metals) a finite strain viscoplasticity model was developed [1]. This constitutive model was incorporated both in AdhoC (implicit) and in the commercial h-FE code HKS/Abaqus/Explicit. The material parameters for the specific constitutive model were identified on the basis of the designed experimental observations. Experiments on relatively complex geometries were then performed in parallel to p- and h-FEM simulations, and results are compared for validation purposes. The excellent results obtained by p-FEM simulations in comparison to experiments and h-FEMs will be presented [2-4].
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