COMPARISON BETWEEN HOMOGENEOUS AND HETEROGENEOUS FIELD INFORMATION FOR PLASTIC MATERIAL IDENTIFICATION

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ABSTRACT:

The accuracy of a Finite Element Simulation for plastic deformation strongly depends on the chosen constitutive laws and the value of the material parameters within these laws. The identification of those mechanical parameters can be done based on homogeneous stress and strain fields such as those obtained in uniaxial tensile tests and simple shear tests performed in different plane material directions. Another way to identify plastic material parameters is by inverse modeling of an experiment exhibiting a heterogeneous stress and strain field. Experimental forces and strains are in this case compared to the simulated ones and it is tried to reduce the difference in a least-squares sense by optimizing the model parameters. The optimization technique used is this case is gradient based, which means that at every iteration a sensitivity calculation has to be performed in order to indicate the direction in which the parameters are to be identified.

The basic principle of the inverse modeling procedure as it is used for parameter identification is the generation of a complex and heterogeneous deformation field that contains as much information as possible about the parameters to be identified. One way of obtaining such a non-homogeneous deformation is by altering the geometry of the specimen for a uniaxial test. Another possibility is to make the loading conditions more complex. In this paper both options are actually combined by using a biaxial tensile test on a perforated cruciform specimen (Fig. 1).

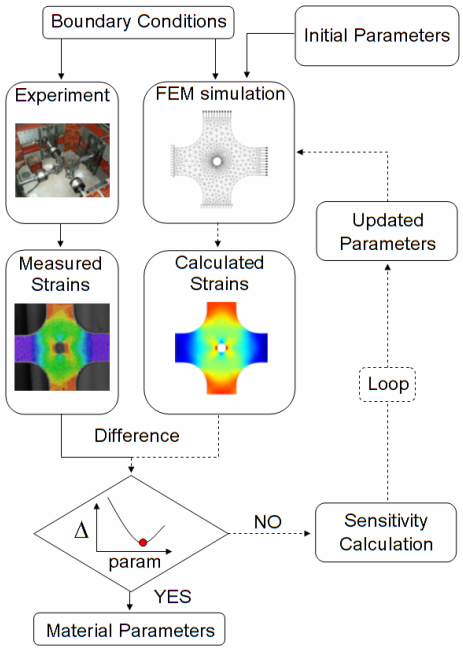

Figure 1- Inverse Modeling Flow-chart

In the present paper, the work hardening of the material is assumed to be isotropic and it is described by a Swift law. The yield locus is modeled by the anisotropic Hill48 criterion. A comparison is made between the identification of the Hill48 parameters based on the one hand on the Lankford coefficients [1] and on the inverse modeling of a biaxial tensile test on the other hand [2].

[1] P. Flores, L. Duchêne et all. Model identification and FE simulations : Effect of different yield loci and hardening laws in sheet forming. Proceedings of the 6th Numisheet Conference, Detroit, Michigan, USA, 2005, p.371-381
[2] D. Lecompte, A. Smits, H. Sol, J. Vantomme and D. Van Hemelrijck, *Elastic orthotropic parameter identification by inverse modelling of biaxial tests using Digital Image Correlation.* 8 th European Mechanics of Materials Conference on Material and structural identification from full-field Measurements Cachan – France 13-15 Sep, 2005, p. 53-60