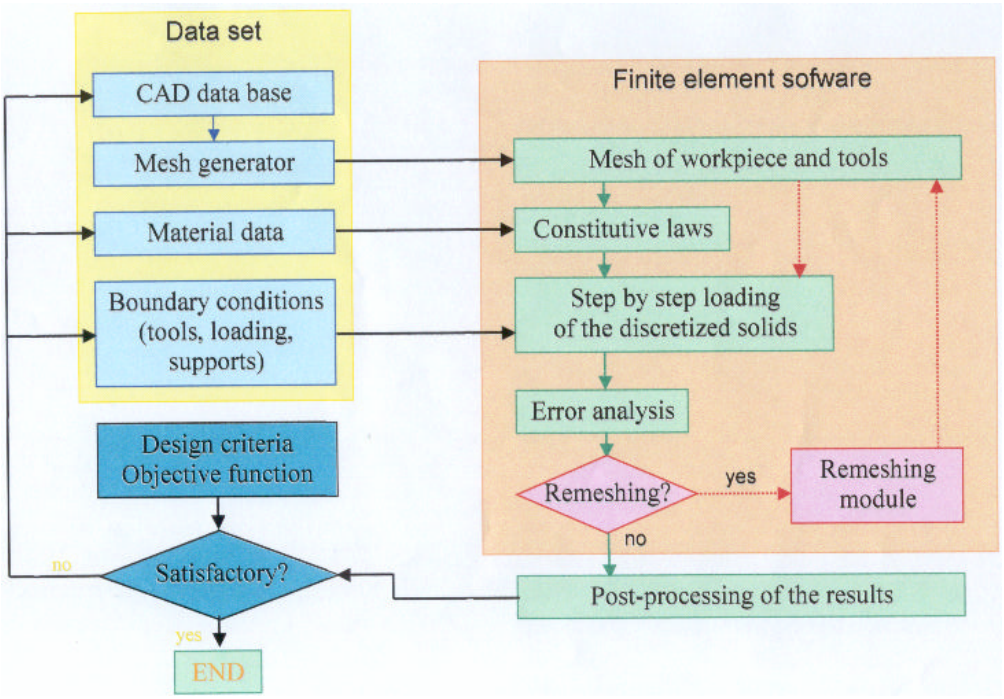
Numerical Modelling of Metal Forming – Current Practice and Advanced Applications

S. Cescotto, L. Duchêne, F. Pascon and A.M. Habraken
M&S - Institut de Mécanique et Génie Civil, University of Liège, Liège, Belgium

ABSTRACT:

The paper is composed of 3 main chapters.

(1) Current possibilities and perspectives of modelling of metalforming processes
A general scheme (figure 1) for the different stages allowing to reach an effective numerical modelling of metalforniing processes is discussed. For each stage, the current state of knowledge is presented and the still unsolved problems are mentioned. A practical point of view is adopted since notions of cost are includes in the discussion (manpower requirement, availability of data, computer cost, etc.).



(2) Advanced modelling of deep drawing
As a first example of advanced modelling, the micro-macro plasticity approach of deep drawing simulations is developed. The basic concepts of the micro-macro transition in metal plasticity are presented. The numerical problems are mentioned and an innovative solution is proposed: it is based on a partial representation of the anisotropic yield locus deuced from crystal plasticity. Its implementation in finite element codes is explained. It is also shown how basis data can be obtained from experiments in order to have a sufficient

description of material behaviour. Finally, the method is illustrated by a number of numerical applications and comparison with laboratory deep drawing experiments.

(3) Advanced modelling of continuous casting

As a second example of advanced application, the modelling of continuous casting is examined, both inside the mould and in the bending-unbending zone at the outlet of the mould. The difficulties to model the liquid-solid phase change, the thermo-mechanical unilateral contact with the walls of the mould and with the rolls of the bending- unbending zone, the acquisition of material data at temperatures close to the melting temperature are examined. An innovative method based on generalised plane state simulations is proposed. Its practical application to an industrial continuous casting plant is presented.