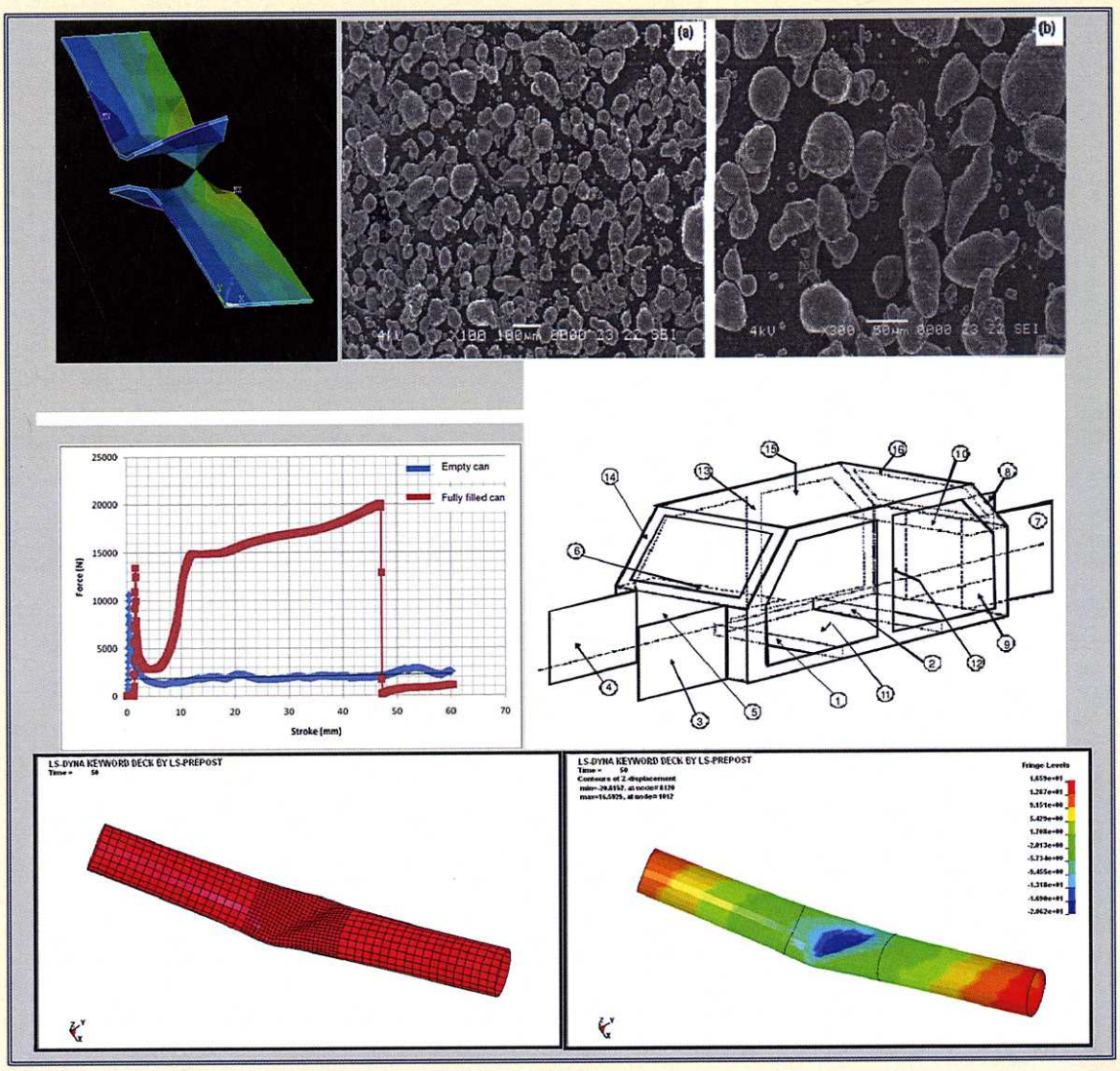
ADVANCED TOPICS IN MECHANICAL BEHAVIOR OF MATERIALS



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Meftah Hrairi

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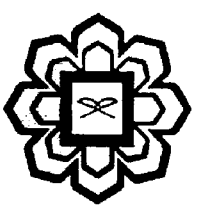

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NUMERICAL SIMULATION OF GREEN COMPACTS

Meftah Hrairi, Asmu'i Hussin

1. INTRODUCTION

In the compaction process of metal powders into rigid dies, one of the most common problems is the part cracking during either the compaction stage or its ejection from die. Therefore, the finite simulation method is considered as design tool for powder metallurgy parts as well as for compaction tooling as this method allows the prediction of any kind of stresses and density distributions of the pressed compact prior to the actual tooling manufacturing activity. For this analysis, ANSYS LS-DYNA is used to facilitate the study of Geological Cap material model.

2. MATERIAL MODEL

The Geological Cap model was originally developed for geological materials. This model has been used to simulate cold die compaction of metal powders and it has shown flexibility in modeling all compaction stages. This model can also be used to simulate the compaction of powders, starting from the loose state up to very high density levels. The first numerical simulations using the Cap model were based on the algorithm proposed by Sandler and Rubin [1]. This algorithm was found not to be fully coherent with the principles of plastic consistency and associativity of the flow rule and was later corrected for these limitations [2]. Hofstetter et al. then proposed an improved formulation of the Cap model yield functions in order to ensure a better numerical stability of the model. They also derived a consistent expression of the algorithmic elastoplastic tangent moduli. The use of this algorithmic moduli in place of the so-called continuum moduli helps to preserve the quadratic rate of convergence when a Newton-Raphson scheme is used for solving the FE problem [3]. As shown in Fig. 2, the Cap model consists of