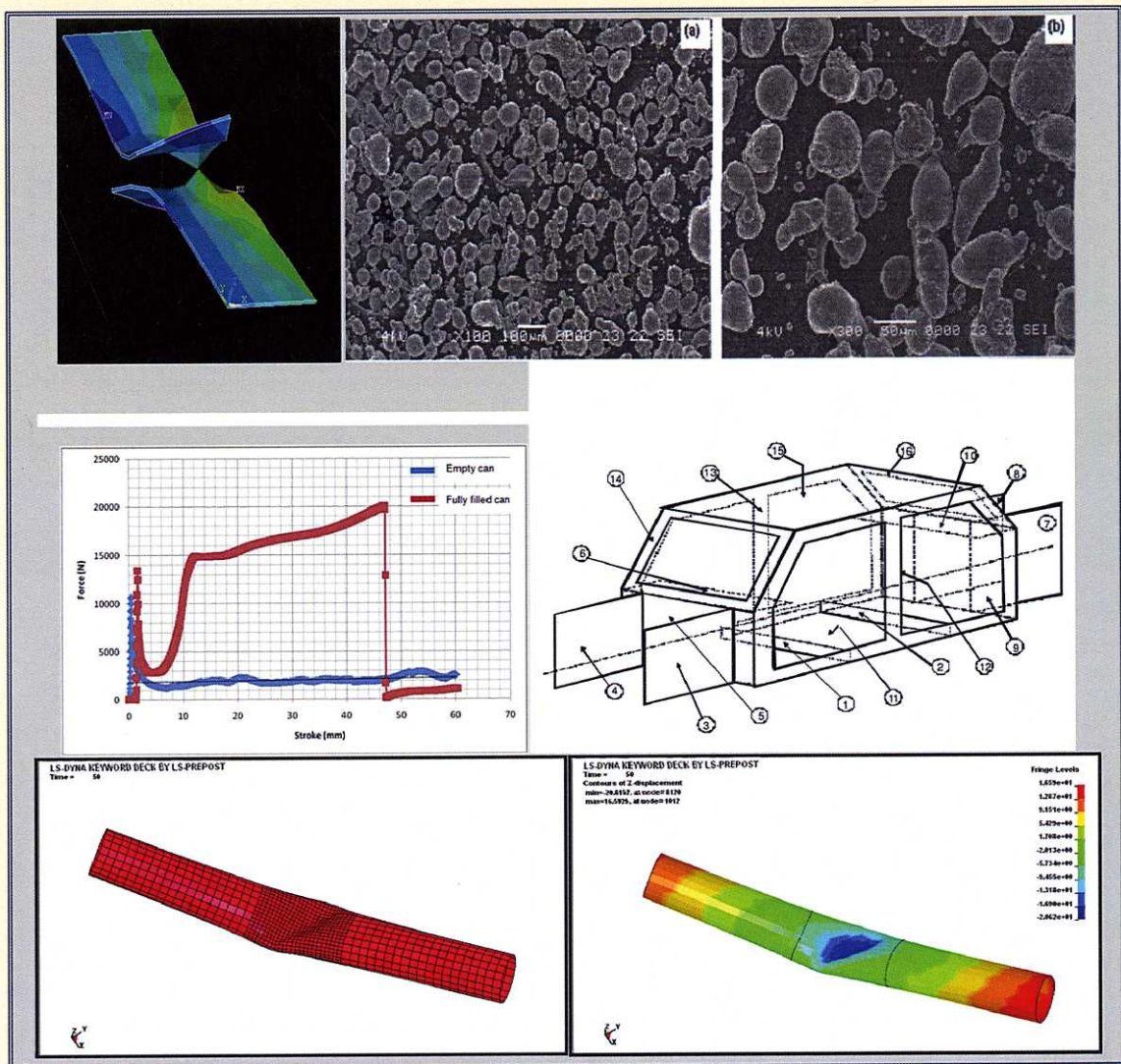


ADVANCED TOPICS IN MECHANICAL BEHAVIOR OF MATERIALS



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Meftah Hrairi



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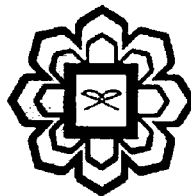
INTERNATIONAL ISLAMIC UNIVERSITY MALAYSIA

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Contents

Preface.....	x
Acknowledgments	xii
Editor.....	xiv
Contributors	xvi

Section 1 Buckling

1	Cylindrical Shell Buckling Under Axial Compression Load	3
	<i>Qasim H. Shah, Hasan M. Abid, Abid B. Rosli</i>	
2	Experimental Setup of Empty and Water Filled Cylindrical Shell Buckling	8
	<i>Qasim H. Shah, Hasan M. Abid, Adib B. Rosli</i>	
3	Experimental Results of Empty and Water Filled Cylindrical Shell Buckling	13
	<i>Qasim H. Shah, Hasan M. Abid, Adib B. Rosli</i>	
4	Experimental Results of Empty and Water Filled Cylindrical Shell Buckling for 50mm Stroke	18
	<i>Qasim H. Shah, Hasan M. Abid, Adib B. Rosli</i>	
5	Experimental Results of Empty and Water Filled Cylindrical Shell Buckling for 60mm Stroke	24
	<i>Qasim H. Shah, Hasan M. Abid, Adib B. Rosli</i>	
6	Simulation Setup of Empty and Water Filled Cylindrical Shell Buckling	30
	<i>Qasim H. Shah, Hasan M. Abid, Adib B. Rosli</i>	
7	Simulation Results of Empty and Water Filled Cylindrical Shell Buckling	35
	<i>Qasim H. Shah, Hasan M. Abid, Adib B. Rosli</i>	
8	Experimental and Simulation Results of Cylindrical Shell Buckling	41
	<i>Qasim H. Shah, Hasan M. Abid, Adib B. Rosli</i>	
9	Buckling and Crush Analysis of Light Weight Structure	48
	<i>Kassim A. Abdullah and Wan Nur Hidayah Wan Sulaiman</i>	
10	Analysis of Lightweight Structural Tubes for Crashworthy Car Body	54
	<i>Kassim A. Abdullah and Zahra Roslan</i>	

Section 2 Impact

11	Pipe Whip Impact	61
	<i>Qasim H. Shah, Hasan M. Abid, Adib B. Rosli</i>	
12	Experimental Setup of Pipe Whip Impact	66
	<i>Qasim H. Shah, Hasan M. Abid, Adib B. Rosli</i>	

13	Experimental Results of Pipe Whip Impact	71
	<i>Qasim H. Shah, Hasan M. Abid, Adib B. Rosli</i>	
14	Simulation Setup of Pipe Whip Impact	77
	<i>Qasim H. Shah, Hasan M. Abid, Adib B. Rosli</i>	
15	Simulation Results of Pipe Whip Impact at 55° Angle	82
	<i>Qasim H. Shah, Hasan M. Abid, Adib B. Rosli</i>	
16	Simulation Results of Pipe Whip Impact at 90° Angle	87
	<i>Qasim H. Shah, Hasan M. Abid, Adib B. Rosli</i>	
17	Failure Mechanism of PC Armor Plates with PMMA Sacrificial Layer Subjected to Impact	93
	<i>Qasim H. Shah, Hasan M. Abid, Adib B. Rosli</i>	
18	Damage of Polycarbonate Armor Plate Subjected to Impact	106
	<i>Qasim H. Shah, Hasan M. Abid, Adib B. Rosli</i>	
19	Finite Element to Predict Damage of a Polycarbonate Armor Plate Subjected to Impact	112
	<i>Qasim H. Shah, Hasan M. Abid, Adib B. Rosli</i>	
20	Energy Absorbing Capability of Materials Subjected to Impact Under Gravity Loading	120
	<i>Qasim H. Shah, Hasan M. Abid, Adib B. Rosli</i>	
21	Damage Assessment of Liquid Filled Container Subjected to Free Fall on Rigid Steel Plate	127
	<i>Qasim H. Shah, Hasan M. Abid, Adib B. Rosli</i>	
22	Numerical Analysis of Materials Energy Absorbing Capability Under Gravity Loading Impact ..	134
	<i>Qasim H. Shah, Hasan M. Abid, Adib B. Rosli</i>	
23	Numerical Assessment of Liquid Filled Container Subjected to Free Fall on Rigid Steel Plate	141
	<i>Qasim H. Shah, Hasan M. Abid, Adib B. Rosli</i>	

Section 3 Design and Manufacturing

24	Overview of the Powder Metallurgy Process	151
	<i>Meftah Hrairi, Asmu'i Hussi, Fadzly Mohamad Ravi</i>	
25	Mechanical Properties of Sintered Aluminum Alloy Compacts	156
	<i>Meftah Hrairi, Fadzly Mohamad Ravi</i>	
26	Numerical Simulation of Green Compacts	161
	<i>Meftah Hrairi, Asmu'i Hussin</i>	
27	Experimental Studies of Dieless Forming	167
	<i>Meftah Hrairi, Saiful Mazwan Nawi</i>	
28	Study of Spot Welding Process	172
	<i>Meftah Hrairi, Fatimah Jamil</i>	
29	General Framework for Inverse Identification of Consecutive Parameters	177

Meftah Hrairi

30	Inverse Parameter Identification of Elastic and Inelastic Constitutive Material Models	183
	<i>Meftah Hrairi</i>	
31	Enhancing Magnetic Particle Testing of Automotive Parts	189
	<i>Meftah Hrairi, Salah Echrif</i>	
32	Design and Fabrication of the Testing Model of the Vehicle Structure Test System	196
	<i>Kassim A. Abdullah and Cheah Siew Loong</i>	
33	Design Analysis of Laminated Composite Ladder Chassis Frame of Light Truck	202
	<i>Kassim A. Abdullah and Mohd Zaimi bin Rosli</i>	
34	Design and Development of Driving System for Disabled Driver	208
	<i>Kassim A. Abdullah, J.S. Mohamed Ali, Mohd Azlan bin Habeeb Rahmathullah, Ruzael Amir Afendi b. Kaharuddin</i>	

Section 4 Liquid Sloshing

35	Liquid Sloshing	215
	<i>Qasim H. Shah, Hasan M. Abid, Adib B. Rosli</i>	
36	Experimental Study of Liquid Slosh Dynamics in a Half Filled Cylindrical Tank	220
	<i>Qasim H. Shah, Hasan M. Abid, Adib B. Rosli</i>	
37	Experimental Results of Liquid Slosh in a Cylindrical Tank with Different Fill Levels	226
	<i>Qasim H. Shah, Hasan M. Abid, Adib B. Rosli</i>	
38	Simulation Model of 3D Liquid Slosh in a Partially Filled Cylindrical Tank	233
	<i>Qasim H. Shah, Hasan M. Abid, Adib B. Rosli</i>	
39	Simulation Results of Liquid Slosh in a Partially Filled Cylindrical Tank	238
	<i>Qasim H. Shah, Hasan M. Abid, Adib B. Rosli</i>	
40	Numerical and Experimental Results of Liquid Slosh in a Partially Filled Cylindrical Tank	242
	<i>Qasim H. Shah, Hasan M. Abid, Adib B. Rosli</i>	
Index.....		247

26

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