

UNIVERSITI TEKNOLOGI MARA

**IMPACT RESPONSE OF TUBULAR
STRUCTURE WITH INTERNALLY
STACKED CIRCULAR TUBES**

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ABSTRACT

Extensive study had been carried out to determine the impact response of various tubular structures. In the event of collision, vehicles are subjected to very high Initial Peak Force (IPF) due to a large change in momentum in a very short period of time. This can lead to severe human injuries and damage to protected goods. But, it can be controlled through structures deformation as shown in the energy-time graph. Low Crush Force Efficiency (CFE) and high fluctuating force normally exist upon deformation which affects the energy absorption capability. This work aims to introduce a new structural configuration and to determine its performance when subjected to axial static and impact loading. Critical parameters that influence the crush response of the structure are determined. The new configuration was made from Aluminium 6063-T5 circular and square tubes, arranged in desired manner. Simulation of finite element analysis was carried out using ABAQUS software. The results were verified by experiment before embarking on further simulation studies. Results showed that the stacked design had commendable impact energy absorbing capability. The IPF value decreased and more energy was absorbed while the CFE value was much higher. Critical parameters were determined as the best crush performance in terms of IPF, CFE and SEA. Finding from this research was used to design UiTM Formula SAE car impact attenuator. Simulation and experimental results showed that the impact attenuator fulfilled the Formula SAE requirements.

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TABLE OF CONTENTS

	Page
CONFIRMATION BY PANEL EXAMINERS	ii
AUTHOR'S DECLARATION	iii
ABSTRACT	iv
ACKNOWLEDGEMENT	v
LIST OF TABLES	ix
LIST OF FIGURES	x
CHAPTER ONE: INTRODUCTION	1
1.1 Research Background	1
1.1.1 Crash Impact Event is Biggest Impact Issues	1
1.1.2 Statistics of road traffic injuries	1
1.1.3 Causes and Consequences of Road Crashes Injuries	3
1.1.4 Impact Energy Absorption of Structures	5
1.2 Axial and Lateral Crushing of Stacked Tubes	6
1.2.1 Lateral Crushing	7
1.2.2 Axial Crushing	8
1.3 Problem Statement	10
1.4 Objectives	12
1.5 Scope of Work and Limitations	13
1.6 Significance of Study	14
1.7 Thesis Methodology	15
1.8 Thesis Outline	16
CHAPTER TWO: LITERATURE REVIEW	18
2.1 Introduction	18
2.1.1 Early Development of Energy Absorber	18
2.2 Energy Absorption	20
2.2.1 Introduction to Energy	20
2.2.2 Conservation of Energy	20
2.2.3 Energy Distribution and Dissipation	22

2.2.4	Crashworthiness	23
2.2.5	Principles of Energy Absorber	25
2.2.6	Type of Energy Absorber and Their Applications	27
2.3	Structures of Energy Absorption	28
2.4	Summary of Literature Review	36
CHAPTER THREE: RESEARCH METHODOLOGY		38
3.1	Introduction	38
3.2	Design Model	42
3.2.1	Square Tube with Internally Stacked Circular Tubes	42
3.2.2	Material Properties	43
3.2.3	Finalization of Design Structure	44
3.3	Finite Element Analysis	45
3.3.1	Finite Element Analysis Software	46
3.3.2	Part Module	47
3.3.3	Properties Module	49
3.3.4	Assembly Module	49
3.3.5	Step module	49
3.3.6	Interaction module	50
3.3.7	Load module	50
3.3.8	Meshing	50
3.3.9	Job module	52
3.3.10	Visualization Module	52
3.4	Fabrication	53
3.5	Experiments	56
3.5.1	Tensile Test	56
3.6	Validation Results	58
3.6.1	Compression Testing	58
3.6.2	Impact Testing	59
3.7	Simulation of Stacked Tubes Subjected to Axial Static and Impact Loading	60
3.7.1	Stacked Arrangement	60
3.7.2	Orientation	61
3.7.3	Thickness and diameter	62