

شبكة المعلومات الجامعية







شبكة المعلومات الجامعية التوثيق الالكتروني والميكروفيلم



شبكة المعلومات الجامعية

# جامعة عين شمس

التوثيق الالكتروني والميكروفيلم

### قسم

نقسم بالله العظيم أن المادة التي تم توثيقها وتسجيلها على هذه الأفلام قد أعدت دون أية تغيرات



يجب أن

تحفظ هذه الأفلام بعيدا عن الغبار في درجة حرارة من ١٥-٥٠ مئوية ورطوبة نسبية من ٢٠-٠٠%. To be Kept away from Dust in Dry Cool place of 15-25- c and relative humidity 20-40%



# بعض الوثائـــق الإصليــة تالفــة



# بالرسالة صفحات لم ترد بالإصل



# AIN SHAMS UNIVERSITY FACULTY OF ENGINEERING AUTOMOTIVE ENGINEERING DEPARTMENT

#### STUDY OF SUSPENSION CONTROL ARM REPLACEMENT BY ANOTHER MADE OF COMPOSITE MATERIALS

B6922

BY

#### ALAA MOHAMED MOHSEN

B.Sc. (1990)

. Thesis Submitted in Partial Fulfillment of the Requirements for the Degree of Master of Science in Mechanical Engineering

#### SUPERVISED BY

Prof. Dr. AHMED HASSAN BAWADY Head of Auto. Eng. Dept., Faculty of Engineering, Ain Shams University

Dr. FAISSAL ELSAYED ABD EL-HADY Lecturer in Auto. Eng. Dept., Faculty of Engineering, Ain Shams University

Dr. NAGLA MARZOUK KANDIL Lecturer in Auto. Eng. Dept., Faculty of Engineering, Ain Shams University

**CAIRO** 1999

Dec

Thes

Exam

Prof. Prof. ... Minia

Prof. Prof. Ain.

779 org niA

## AIN SHAMS UNIVERSITY FACULTY OF ENGINEERING

M.Sc. Thesis

Name: Alaa Mohmed Mohsen

Degree: M.Sc.

Thesis Title: "Study of Suspension Control Arm Replacement by Another Made of Composite Materials"

Signature

Prof. Dr. Fawzy Mohamed El-Sayed

Prof. of Automotive Engineering Minia University

**Examiner**"s Committee

EL-Sayed F.M.

Prof. Dr. Mohamed Sabry El-Sayed Dwidar

Prof. of Automotive Engineering Ain Shams University

Prof. Dr. Ahmed Hassan Bawady

Prof. of Heat Engines Ain Shams University A. Bawady

of take

aid in

bave

the

15

1

#### **ACKNOWLEDGEMENT**

The author would like to express his deep gratitude and thanks to his supervisor Prof. Dr. AHMED HASSAN BAWADY, without his precious guidance, continued encouragement, this work might not have been completed. Also all gratitude to him for the help in solving the problems encountered during the accomplishing of this work.

The author would like to acknowledge the supervising of Dr. FAISSAL ELSAYED ABD EL-HADY for his advises encouragement, and his devotion in presenting aid and help.

Many thanks to Dr. NAGLA MARZOUK KANDIL for her continuous help and support throughout my research work.

The author would like to present his thanks to his family, without their patience, this work might not have been finished. Master

notive 996

ार्च अ

1

#### Statement

This dissertation is submitted to Ain Shams University for the degree of Master of Science in Mechanical Engineering (Automotive Engineering).

The work included in this thesis was carried out by the author in the Automotive Engineering Department, Faculty of Engineering, Ain Shams University, from 1996 to 1999.

Signature:

Name: ALAA MOHAMED

#### TABLE OF CONTENTS

	Page
TABLE OF CONTENTS	I
ABSTRACT	V
LIST OF FIGURES	
NOMENCLATURE	
INTRODUCTION	1
STRUCTURAL COMPONENT DESIGN TECHNIQUES	2
THE PROBLEM OF RESEARCHTHE FAILURE OF CHASSIS OF FIAT 128	3
THE PURPOSES OF RESEARCH	3
THE IMPORTANCE OF RESEARCH	3
THE TOOLS OF RESEARCH	4
CHAPTER 1: INTRODUCTION TO COMPOSITE MATERIALS	9
1.1 INTRODUCTION	10
1.2 APPLICATIONS	10
1.2.1 CARS AND TRUCKS AND AUTO COMPONENTS	10
1.3 FACTORS AFFECTING PERFORMANCE OF FIBER-MATRIX COMPOSITE	
1.3.1 FIBER FACTORS	16
1.3.1.1 Orientation	16
1.3.1.2 Length	17
1.3.1.3 Shape	18
1.3.2 THE MATRIX	
1.3.2.1 Factors of Importance in Resin Choice	18
1.3.3 THE BONDING PHASE	

	Page
1.4 TYPES OF FIBER-MATRIX	21
1.4.1 INORGANIC FIBERS IN ORGANIC MATRIX	21
1.5 GLASS FIBERS	21
5EA66	
THE PROPERTY OF CLASS-FIDER-REINFIDER FILL DI ACTION	
1.5.3.1 Principle 1	26
1.5.3.1.1 Amount of glass	26
1.5.3.1.2 Arrangement of glass	26
1.5.3.1.4 Glass reinforcements	27
THOUSE S	
1.5.3.4 Principle 4	29
1.6 THERMOSET POLYMER MATRICES	29
1.6.1 EPOXIES  1.6.1.1 Structure	29
1.6.1.1 Structure  1.6.1.2 Types and Forms  1.6.1.3 Characteristic	29
1.6.1.3 Characteristic	33
	34
1.7 MANUFACTURING TECHNIQUES	25
THE THE PART OF TH	
o i termett i vallabilata	
THE CONTRACTOR OF THE CONTRACT	
1.7.8 COLD PRESS	41
1.8 STRENGTH OF COMPOSITE	
I ALUNE CRITERIA	
THE THE TENDE I LINGLE AND LUMPRESCUE TECTS	
TOTAL STILAR 1EST	
1.8.8 STRENGTH RATIOS	46
1.9 CONCLUSION	54
CHAPTER 2: INDEPENDENT FRONT SUSPENSION	
2.1 INTRODUCTION	
2.2 FRONT END GEOMETRY	56