AIN SHAMS UNIVERSITY
FACULTY OF ENGINEERING

THE MECHANICAL BEHAVIOUR OF POLYMER-BASED MATERIALS AND STRUCTURES

by

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بسم الله الرحمن الرحيم

STATEMENT

This dissertation is submitted to Ain Shams University for the Degree of Doctor of Philosophy in Mechanical Engineering.

The work included in this thesis was carried out by the authoress at the Mechanical and Materials Department, Ecole des Mines de Saint-Etienne, France and at the Department of Energy and Automotive Engineering, Ain Sams University . Egypt, from December 1988 to March 1992

No part of this thesis has been submitted for a degree or a qualification at any other University or Institution

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DEDICATION

I would like to dedicate this work to my husband and parents, who without their continuous support and patience, this thesis could not have been accomplished, and to my children hoping that one day they would understand and forgive my absence.

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CONTENTS

CHAPTER 3: METHODS AND TECHNOLOGIES OF MANUFACTURING COMPOSITE MATERIALS

CHAPTER 4 : CONSTRUCTION OF A PROTOTYPE FILAMENT WINDING MACHINE

CHAPTER 5 : MANIPULATING THE MACHINE

NOMENCLATURE

Symbol	Significance	Unit
a	inner radius of cylinder	[m]
b	outer radius of cylinder	[m]
C	stiffness	[GPa]
E	Young's Modulus	[GPa]
G	shear Modulus	[GPa]
h	laminate thickness	[m]
Pb	burst pressure	[MPa]
Q	stiffness	[Gpa]
q(i)	internal pressure	[MPa]
q(e)	external pressure	[MPa]
R	strength ratio	------
S	longitudinal shear strength	[GPa]
Vf	volume fraction of fiber	-------
Vm	volume fraction of matrix	-------
X	longitudinal tensile strength	[GPa]
X'	longitudinal compressive strength	[GPa]
Y	transverse tensile strength	[GPa]

Y'	transverse compressive strength	[GPa]
ε	strain	------
ν	Poisson's ratio	------
ρ	specific density	[kg/m3]
σ	stress	[MPA]
σ_r	radial sress	[MPa[
σ_θ	hoop stress	[MPa]
σ_z	axial stress	[MPa]
f	index for fiber properties	
m	index for matrix properties	
z,θ,r	cylindrical coordinates	
1,2,3,4,5,6	off-axis coordinates	
x,y,z,t,u,s	on-axis coordinates	