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**STRESS AND FAILURE ANALYSIS OF
COMPOSITE MATERIALS
USING
FINITE ELEMENT METHOD**

A thesis presented
in partial fulfilment of the requirements
for the degree of
Master of Technology
in Production Technology at
Massey University

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To my family who gave me great
support and assistant during preparation of this dissertation.

*In the Name of Allah (God),
the most Merciful, the most Compassionate*

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CONTENTS

Acknowledgements	4
Summary	5
Chapter 1 Literature Survey	6
1.1 Introduction	6
1.2 An introduction to Finite Element Method	8
1.3 Mechanics of Composite Materials	10
1.3.1 Introduction	10
1.3.2 Axial Tensile Strength	11
1.3.3 Axial Compressive stress	14
1.3.4 Transverse Strength Properties	15
1.3.5 Mechanics of fabric reinforcement	17
1.4 Failure Criteria for Composite Materials	19
1.4.1 Introduction	19
1.4.2 Strength Criteria for Orthotropic Homogenous Materials	19
1.4.2.1 Maximum Stress Criterion	20
1.4.2.2 Maximum Strain Criterion	21
1.4.2.3 Quadratic Interaction Criterion	21
1.4.2.3.1 Tsai-Hill Criterion	22
1.4.2.3.2 Haffman Criterion	23
1.4.2.3.3 Von Mises Plane Stress Analogy	23
1.4.2.4 Strain Space Expression of Quadratic Interaction criterion	25
1.2.3 Strength Criteria for Laminated Orthotropic Materials	26
1.2.3.1 Failure of Laminates	26
Chapter 2 Recognized Limitations of MYSTRO and LUSAS Finite Element Softwares	28
2.1 Introduction	28
2.2 Limitations	28
2.2.1 Common Limitations	28
2.2.2 Serious Limitations	29

4.5	Single Crimped Fibre-Matrix Model	89
4.5.1	Thick Cylindrical Matrix or (Big Matrix Volume Fraction)	89
4.5.1.1	Stress Analysis	89
4.5.1.1.1	Normal Stress in the y-Direction	89
4.5.1.1.2	Normal Stress in the x-Direction	91
4.5.1.1.3	Normal Stress in the z-Direction	92
4.5.1.1.4	Shear Stress on the xy-Plane	94
4.5.1.1.5	Shear Stress on the xz-Plane	94
4.5.1.1.6	Shear Stress on the yz-Plane	96
4.5.1.2	Failure Analysis	97
4.5.1.2.1	Maximum Normal Stress Criterion	97
4.5.1.2.2	Maximum Normal Strain Criterion	98
4.5.1.2.3	Maximum Shear Stress Criterion	101
4.5.1.2.4	Maximum Distortional Energy Criterion	103
4.5.2	Thin Cylindrical Matrix or (Small Matrix Volume Fraction)	104
4.5.2.1	Stress Analysis	104
4.5.2.2	Failure Analysis	108
4.5.2.2.1	Maximum Normal Stress Criterion	108
4.5.2.2.2	Maximum Normal Strain Criterion	109
4.5.2.2.3	Maximum Shear Stress Criterion	109
4.5.2.2.4	Maximum Distortional Energy Criterion	111
4.5.2.2.5	Conclusin	112
4.6	Interlaced Fibres-Matrix Model	114
4.6.1	Stress Analysis	114
4.6.1.1	Normal Stress in the y-Direction	114
4.6.1.2	Normal Stress in the x-Direction	116
4.6.1.3	Normal Stress in the z-Direction	118
4.6.1.4	Shear Stress Components	119
4.6.2	Failure Analysis	120
4.6.2.1	Maximum Normal Stress Criterion	120
4.6.2.2	Maximum Normal Strain Criterion	122
4.6.2.3	Maximum Shear Stress Criterion	123
4.6.2.4	Maximum Distortional Energy Criterion	125
Chapter 5 General Discussion and Conclusion		127
5.1	Introduction	127
5.2	Results Comparison	127
5.3	Conclusion	129
5.4	Recommendations	130
References		132
Appendix A		135

Chapter 3	Materials and Methods	31
3.1	Introduction	31
3.2	Model Configuration	31
3.3	Material Properties	35
3.4	Loading	36
3.5	Boundary Conditions	38
3.6	Finite Element Modelling	39
3.6.1	The Experimental Procedure	40
3.6.1.1	Pre-Processing (by MYSTRO)	40
3.6.1.2	Finite Element Analysis (by LUSAS)	40
3.6.1.3	Post-Processing Analysis (by MYSTRO)	41
3.6.2	Model Discretization	41
Chapter 4	Results and Model Discussion	44
4.1	Introduction	44
4.2	Straight Fibre-Matrix Model	45
4.2.1	Stress Analysis	45
4.2.2	Failure Analysis	50
4.2.2.1	Maximum Normal Stress Criterion	51
4.2.2.2	Maximum Normal Strain Criterion	54
4.2.2.3	Maximum Shear Stress Criterion	56
4.2.2.4	Maximum Distortional Energy Criterion	58
4.2.2.5	Conclusion	60
4.3	Single Crimped Fibre Model	61
4.3.1	Stress Analysis	61
4.3.1.1	Normal Stress in the y-Direction	61
4.3.1.2	Normal Stress in the x-Direction	65
4.3.1.3	Normal Stress in the z-Direction	67
4.3.1.4	Shear Stress on the xy-Plane	67
4.3.1.5	Shear Stress on the xz-Plane	69
4.3.1.6	Shear Stress on the yz-Plane	72
4.3.2	Failure Analysis	74
4.4	Interlaced Fibres Model	76
4.4.1	Stress Analysis	76
4.4.1.1	Normal Stress in the y-Direction	76
4.4.1.2	Normal Stress in the x-Direction	79
4.4.1.3	Normal Stress in the z-Direction	79
4.4.1.4	Shear Stress on the xy-Plane	82
4.4.1.5	Shear Stress on the yz-Plane	84
4.4.1.6	Shear Stress on the xz-Plane	84
4.4.2	Failure Analysis	86

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SUMMARY

STRESS AND FAILURE ANALYSIS OF GLASS/POLYESTER WOVEN ROVINGS COMPOSITE MATERIALS

A micro-mechanistic approach was performed with three-dimensional finite element analysis of stress and failure of glass/polyester woven roving mat composites. In this study the pre- and post-processor software MYSTRO and the finite element analysis software LUSAS were utilised.

The effects of a crimp (curvature), weft fibre, and the matrix volume fraction on the stress distribution and failure of a single short fibre, with 10 μm diameter and 50 mm length, subject to a tensile load, were studied. With the assumption of a perfect fibre-matrix interface the following were concluded:

- A) Any curvature along the length of the fibre causes a big internal stress concentration which depends on the radius of the curvature.
- B) With an increase of the matrix volume fraction, the stress concentration factor (S.C.F.) decreases.
- C) Any direct contact between the interlaced fibres in the cross cover region can cause the fibre failure mode to occur before the other failure modes.
- D) The composite failure initiates at the crimped area and propagates along the length of the fibre as a debonding phenomenon. This is followed by matrix failure mode and finally the composite will collapse by the fibre fracture mode.