

Table of Contents

| | |
|--------------------------------------------------------------------------------|-----------|
| Abstract | ii |
| Acknowledgments | iv |
| Chapter 1 Introduction | 1 |
| 1.1 Problem Description | 2 |
| 1.2 Solution Approach | 4 |
| 1.3 Remainder of Document | 9 |
| Chapter 2 Effect of Elliptical Geometry on Cylinder Response | 11 |
| 2.1 Numerical Values of Problem Parameters | 11 |
| 2.2 Displacements | 13 |
| 2.3 Strains and Curvatures | 17 |
| 2.4 Force and Moment Resultants | 23 |
| 2.5 Summary of the Effects of Ellipticity | 30 |
| Chapter 3 Effect of Geometric Nonlinearities on Cylinder Response | 32 |
| 3.1 Displacements | 32 |
| 3.2 Strains and Curvatures | 37 |
| 3.3 Force and Moment Resultants | 41 |
| 3.4 Summary of the Effects of Nonlinearity | 48 |
| Chapter 4 Effect of Material Orthotropy on Cylinder Response | 50 |
| 4.1 Displacements | 51 |
| 4.2 Strains and Curvatures | 54 |
| 4.3 Force and Moment Resultants | 60 |
| 4.4 Summary of the Effects of Orthotropy | 69 |
| Chapter 5 Failure Analysis | 71 |
| 5.1 Failure Criteria | 71 |
| 5.1.1 Maximum Stress Theory | 72 |
| 5.1.2 Hashin Theory | 73 |

| | | |
|-------------------|------------------------------------------------------------------|------------|
| 5.2 | Determination of Stresses | 75 |
| 5.2.1 | Inplane Stresses..... | 76 |
| 5.2.2 | Interlaminar Stresses..... | 77 |
| 5.3 | Character of Interlaminar Stresses..... | 85 |
| 5.4 | Interlaminar Shear Stress Validation..... | 88 |
| Chapter 6 | Failure Predictions | 91 |
| 6.1 | Failure Predictions for the Geometrically Linear Theory | 91 |
| 6.2 | Failure Predictions from the Geometrically Nonlinear Theory..... | 98 |
| 6.3 | An Alternative View of Failure Predictions | 107 |
| Chapter 7 | Conclusions and Future Work | 115 |
| 7.1 | Summary | 115 |
| 7.2 | Conclusions | 115 |
| 7.3 | Future Work..... | 120 |
| 7.3.1 | Numerical | 120 |
| 7.3.2 | Experimental..... | 121 |
| References | | 122 |
| Appendix A | Comparison between Present and STAGS Results..... | 123 |
| Appendix B | Axial Displacement Required for each Pressure..... | 143 |
| Vita | | 146 |