

Overview

One of the major challenges facing the composites community is the extent to which we can make a transition from the properties of materials to the application of composites to safe, reliable structures. This transition is a very complex process which includes design of the structure, analysis of the design, experimental verification of the analysis, and final certification of the structure. Each of the four papers presented in this session deal with one or more aspects of this transition process.

The first paper in this session by Paul, Saff, Sanger, et al. describes the "Analysis and Test Techniques for Composite Structures Subjected to Out-of-Plane Loads." The first part of the paper contains a summary of several analytical packages developed for the preliminary analysis of laminate corner radii stresses, flange-to-skin bondline stresses, and stiffener runout stresses. The second part of the paper describes relatively simple test methods for the verification of these analyses.

The next paper entitled "Analysis and Testing of a Composite Sandwich Shell Horizontal Tail" by Sherrouse and McWhorter investigates the feasibility of an all-composite horizontal tail for light aircraft. This type of structure offers many advantages over conventional tail structures by simplifying construction, reducing weight, and requiring far fewer fasteners. The paper describes the design, analysis, fabrication, and experimental testing of the structure subjected to various point loads. The final section compares the analytical and experimental results.

The third paper entitled, "Composite Material Stub-Blade Wing Joint" by Franklin and Kreimendahl describes the design of an all-composite stub-blade joint for high-altitude, long-endurance aircraft which incorporate removable, composite wing structures with large spans and high aspect ratios. The main body of the paper is divided into three major sections. The first section describes the design philosophy including design requirements, possible design alternatives, and justification of the final design selection. The second section presents a detailed description and analysis of the final design, and the final section compares the all-composite blade joint to a traditional, titanium tension fitting.

The final paper in this session entitled, "Temperature and Load Cycling of a Thick Polyimide Quartz Laminate" by Laurencot and Keen describes the temperature and out-of-plane load cycling on a thick polyimide/quartz V-shaped sub-element. The paper presents detailed descriptions of the experimental test setup, applied load history, and measured response of the material.

All of these papers describe the application of composite materials to complex engineering structures. In some of the papers, the authors investigate the design of all composite structures, and in other cases, the authors describe highly specialized experimental techniques based on well-established ASTM procedures. Overall, each of these papers exemplify a portion of this transition from properties of laboratory coupons to complex, yet reliable, engineering structures.