

Book Review

Analysis and Performance of Fiber Composites

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REFERENCE: Agarwal, D. and Broutman, L. J., *Analysis and Performance of Fiber Composites*. John Wiley and Sons, Somerset, N.J., 1980, 349 pages.

This book is the product of an effort by two authors commissioned by the Society of Plastics Engineers. The Society's Technical Volumes Committee also directed the writing of the book and reviewed its contents.

The book is organized along two general directions. The systematic development of the subject, example problems with solutions, and exercise problems make the book a suitable textbook for an introductory treatment of the subject. At the same time, there is an unusual portion of commentary, comparative discussions, experimental data, property data and design, as well as service-related information, making the book a good shelf reference for the practicing engineer.

Choice of what to include in the book appears to have been made with a fairly heavy bias toward the "materials" side of the field, especially in comparison to other available comparable books. While most of the basic elementary micromechanics and laminate analysis equations are stated in the text, development of the equations is limited to about 40 pages of appendixes at the end of the book. However, this reviewer has no particular disagreement with the subjects covered analytically for this level of text and was pleased to find such subjects as interlaminar stresses, edge effects, and stiffness reduction dealt with quantitatively. Another interesting detail of the presentation is the dedication of a separate chapters to short-fiber composites, orthotropic lamina, and (orthotropic) laminated composites. Another particularly useful aspect of the book is its strong treatment of materials characteriza-

tion, including discussions of various tests for the determination of materials properties. Discussions of fatigue, impact, and environmentally affected behavior is also included, a welcome addition not commonly found in such works. Throughout the book design-level and "rule of thumb" formulas are stated relating constituent properties to lamina and laminate properties, and so forth.

All books have shortcomings in the eyes of their users (with, perhaps, the exception of the authors themselves). My greatest reservation about the book concerns the limited development of the subject, especially from the standpoint of mechanics. This is, quite certainly, an introductory text and it will be very useful as such. But it would surprise this reviewer if the beginning student or engineer could obtain from the book the kind of understanding of mechanical behavior that would allow him to develop a thorough or general perception of the mechanics of composite materials. The analysis referred to in the title does not extend beyond an elementary development of laminate analysis, except through quoted results for edge effects and stress concentrations. Just one other limitation is general enough to call to the attention of the reader. It is particularly disappointing in a book that deals preferentially with material properties and the materials aspects of response to find virtually no discussion of the statistical aspects of either of those subjects. In the opinion of this reviewer, no one should attempt to use composite materials or attempt to understand their behavior without developing a sound appreciation for the statistical nature of their properties and behavior. Such an appreciation could not be gotten from this book.

In summary, I found this book to be very carefully written, well documented, well organized, and well illustrated. I would not hesitate to recommend the book to a student or engineer who wished to learn about composite materials at an introductory level. There is a significant amount of "materials" information that is not found in collected form elsewhere. The shortcomings of the book have mostly to do with the limited coverage, in my opinion.