

# Book Review

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## ***Mechanics of Composite Structures***

Valery V. Vasiliev, Taylor & Francis, Washington, DC, 1993, 506 pp., \$99.00

This is a very good book on mechanics of common structural elements such as beams, columns, rings, thin-walled beams, plates, panels, and shells made of composite materials. While there are several other books that cover most of these topics, the present book's unique features are the coverage of thin-walled beams and a balanced treatment of theory and design concepts. Special topics such as non-linear behavior, post buckling, dynamic behavior, beams with open section contours, and boundary layer theory are also discussed.

The book is organized into seven chapters: Introduction to Structural Properties of Composite Materials; Equations of Composite Structure Mechanics; Composite Beams, Columns, and Rings; Thin-Walled Beams; Composite Panels and Plates; Circular Cylindrical Shells; and Axisymmetric Deformation of Shells of Revolution. At the end of the book there is a list of 48 references, mostly from the former Soviet literature, and a brief index of topics and authors.

The following positive aspects of the book are worth noting. The book provides a good overview of the different composite systems in use, with particular reference to manufacturing aspects. The author has examined in detail the ramifications of several approximations involved in the construction of the equations and the consequences of imposing different types of boundary conditions on the system. An extensive treatment is given of kinematics and constitutive equations of thick and thin homogeneous and layered thin-walled beams, and practical engineering structures such as lattice and sandwich structures. A fairly extensive treatment of the hygrothermal and thermoelastic response is given and attention is also focused on the study of stiffened panels and rings. Finally, the art work is excellent.

However, the book also has some deficiencies. The author uses the same Greek symbols to denote physical variables, subscripts, and coordinate systems. For example,  $\alpha$ ,  $\beta$ , and  $\gamma$  are used as coordinates as well as subscripts;  $\rho$  is used to denote density as well as a subscript. Also, the author does not clearly differentiate be-

tween the strain energy density  $U_\epsilon$  and the complementary strain energy density  $U_\sigma$ . The phrase "potential energy of deformation" is used for strain energy in a few places (e.g., p. 44). The phrases "strain energy density" and "complementary strain energy density" have been used interchangeably in places.

While the book attempts to provide a deeper understanding into the physics of the problem, it does not focus on problem solving. No examples or exercises are provided to make the book readily adoptable as a textbook. In addition, all structures considered in the book are treated as special cases of a body whose equilibrium equations are derived in an orthogonal curvilinear coordinate system. This deductive approach is convenient from the derivation point of view, but it makes the reader cope with mathematical abstraction at the expense of physical understanding.

This book does not contain an overview of the variational principles, the traditional variational methods (e.g., the Rayleigh-Ritz and Galerkin methods), or the finite element method. Also, a brief discussion and reference to refined shear deformation theories would have made the book more complete and up to date.

Overall, this book is a valuable addition to the literature, and analysis-oriented designers would benefit from the topics discussed herein. If this book were to be used as a textbook for a graduate course on mechanics of composite structures (after a course from a book like *Mechanics of Composite Materials* by Robert M. Jones), the instructor would be required to prepare additional lecture notes on variational principles, variational methods, and direct derivation of equations for simple structural elements, as well as example problems and exercise problems.

The book is recommended as a reference for all engineers working with composite materials and structures and can also be used as a textbook with supplementary notes.

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