Preface

The increased use of composites in aerospace, land, and marine applications has resulted in a growing demand for engineers versed in the design of structures made of fiber-reinforced composite materials. To satisfy this demand, and to introduce engineers to the subject of composites, numerous excellent texts have been published dealing with the mechanics of composites. These texts deal with those fundamental aspects needed by engineers new to the subject. Our book addresses topics not generally covered by existing texts but that are necessary for designing practical structures. Among the topics in this book of special interest to the designer, but that usually are not included in standard texts, are stress–strain relationships for a wide range of anisotropic materials; bending, buckling, and vibration of plates; bending, torsion, buckling, and vibration of solid as well as thin-walled beams; shells; hygrothermal stresses and strains; and finite element formulation. The material is presented in sufficient detail to enable the reader to follow the developments leading to the final results. The expressions resulting from the analyses are either readily usable or can be translated into a computer algorithm. Thus, the book should be useful to students and researchers wishing to acquire knowledge of some of the advanced concepts of the mechanics of composites as well as to engineers engaged in the design of structures made of composite materials.

The emphasis is on analyses built on fundamental concepts that are applicable to a variety of structural design problems. In presenting the material we have strived to follow the outline commonly used in texts dealing with the analysis of structures made of isotropic materials. We have consciously omitted empirical approaches. Test results are certainly of value to the engineer. However, for composites, these mostly apply only under specific circumstances and cannot readily be generalized to different materials and different applications. We have included material properties data to help the designer perform calculations without the need to search the literature.

The book is self-contained. Nevertheless, the reader will find it helpful to have a background in mechanics and in composites and some knowledge of differential

equations and matrix algebra. We have made an effort to keep the notation as uniform as practicable and reasonably consistent with accepted usage. The principal symbols are summarized in a list of symbols.

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