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Andreas Öchsner

Micromechanics of Fiber-Reinforced Laminae

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Preface

Composite materials, especially fiber-reinforced composites, are gaining increasing importance since they can overcome the limits of many structures based on classical metals. Particularly, the combination of a matrix with fibers provides far better properties than the components alone. Despite their importance, many engineering degree programs do not treat the mechanical behavior of this class of advanced structured materials in detail, at least on the Bachelor degree level. Thus, some engineers are not able to thoroughly apply and introduce these modern engineering materials in their design process.

This SpringerBriefs volume provides the first introduction to the mircomechanics of fiber-reinforced laminae, which deals with the prediction of the macroscopic mechanical lamina properties based on the mechanical properties of the constituents, i.e., fibers and matrix. The focus is on unidirectional lamina which can be described based on orthotropic constitutive equations. Three classical approaches to predict the elastic properties, i.e., the mechanics of materials approach, the elasticity solutions with contiguity after Tsai, and the Halpin-Tsai relationships, are presented. The quality of each prediction is benchmarked based on two different sets of experimental values. The volume concludes with optimized representations, which were obtained based on the least squares approach for the used experimental data sets.

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