



# Damage Tolerance and Durability of Material Systems

*Kenneth L. Reifsnider, Scott W. Case*

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A daring, original approach to understanding and predicting the mechanical behavior of materials

"Damage is an abstraction . . . Strength is an observable, an independent variable that can be measured, with clear and familiar engineering definitions."

-from the Preface to *Damage Tolerance and Durability of Material Systems*

Long-term behavior is one of the most challenging and important aspects of material engineering. There is a great need for a useful conceptual or operational framework for measuring long-term behavior. As much a revolution in philosophy as an engineering text, *Damage Tolerance and Durability of Material Systems* postulates a new mechanistic philosophy and methodology for predicting the remaining strength and life of engineering material. This philosophy associates the local physical changes in material states and stress states caused by time-variable applied environments with global properties and performance.

There are three fundamental issues associated with the mechanical behavior of engineering materials and structures: their stiffness, strength, and life. Treating these issues from the standpoint of technical difficulty, time, and cost for characterization, and relationship to safety, reliability, liability, and economy, the authors explore such topics as:

- \* Damage tolerance and failure modes
- \* Factors that determine composite strength
- \* Micromechanical models of composite stiffness and strength
- \* Stiffness evolution
- \* Strength evolution during damage accumulation
- \* Non-uniform stress states
- \* Lifetime prediction

With a robust selection of example applications and case studies, this book takes a step toward the fulfillment of a vision of a future in which the prediction of physical properties from first principles will make possible the creation and application of new materials and material systems at a remarkable cost savings.

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