



Inelastic Deformation of Metals: Models, Mechanical Properties, and Metallurgy

Donald C. Stouffer, L. Thomas Dame

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Using a totally new approach, this groundbreaking book establishes the logical connections between metallurgy, materials modeling, and numerical applications. In recognition of the fact that classical methods are inadequate when time effects are present, or when certain types of multiaxial loads are applied, the new, physically based state variable method has evolved to meet these needs. *Inelastic Deformation of Metals* is the first comprehensive presentation of this new technology in book form. It develops physically based, numerically efficient, and accurate methods for predicting the inelastic response of metals under a variety of loading and environmental conditions.

More specifically, *Inelastic Deformation of Metals*:

- * Demonstrates how to use the metallurgical information to develop material models for structural simulations and low cyclic fatigue predictions. It presents the key features of classical and state variable modeling, describes the different types of models and their attributes, and provides methods for developing models for special situations. This book's innovative approach covers such new topics as multiaxial loading, thermomechanical loading, and single crystal superalloys.
- * Provides comparisons between data and theory to help the reader make meaningful judgments about the value and accuracy of a particular model and to instill an understanding of how metals respond in real service environments.
- * Analyzes the numerical methods associated with nonlinear constitutive modeling, including time independent, time dependent numerical procedures, time integration schemes, inversion techniques, and sub-incrementing.

Inelastic Deformation of Metals is designed to give the professional engineer and advanced student new and expanded knowledge of metals and modeling that will lead to more accurate judgments and more efficient designs.

In contrast to existing plasticity books, which discuss few if any correlations between data and models, this breakthrough volume shows engineers and advanced students how materials and models actually do behave in real service environments. As greater demands are placed on technology, the need for more meaningful judgments and more efficient designs increases dramatically. Incorporating the state variable approach, *Inelastic Deformation of Metals*:

- * Provides an overview of a wide variety of metal response characteristics for rate dependent and rate independent loading conditions
- * Shows the correlations between the mechanical response properties and the deformation mechanisms, and describes how to use this information in constitutive modeling
- * Presents different modeling options and discusses the usefulness and limitations of each modeling approach, with material parameters for each model
- * Offers numerous examples of material response and correlation with model predictions for many alloys
- * Shows how to implement nonlinear material models in stand-alone constitutive model codes and finite element codes

An innovative, comprehensive, and essential book, Inelastic Deformation of Metals will help practicing engineers and advanced students in mechanical, aerospace, civil, and metallurgical engineering increase their professional skills in the modern technological environment.

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Karen Strickland:

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