

Preface

This book is a collection of papers devoted to modeling of inelastic material behavior related to structures under normal and advanced conditions. At the moment there exist various approaches, among them phenomenological, mechanism-based, physically motivated, and others. In this sense this book is some kind of a state of the art.

Accurate and realistic modeling of inelastic behavior of advanced materials is essential for the solution of a numerous boundary-value problems occurring in different engineering fields. For example, various microscopic defects cause reduction in strength of materials and shorten the lifetime of engineering structures. Therefore, a main issue in engineering applications is to provide realistic information on the stress distribution within elements of such materials or assessment of safety factor against failure.

During the last years important progress has been observed in the testing practice for monotonic and cyclic behavior delivering important information on deformation patterns and damage evolution in interaction with material microstructure. Great efforts have been made in the attempt to develop more physically based constitutive models for predicting the occurrence of damage and failure in materials and structures under general loading conditions. At the same time, different research fields in solid mechanics and, especially, modeling of advanced materials have evolved due to development of multi-scale approaches. Although some progress has been made in theoretical fields, the application of multi-scale models to numerically analyze real components subjected to monotonic and cyclic loading conditions is still at an early stage. Different research groups around the world have proposed promising approaches and part of them are discussed in the present book.

The aim of the book is not only to consolidate the advances in inelastic material research but also to provide a forum to discuss new trends in damage and fracture mechanics proposing models that are either phenomenological ones or micro-mechanically motivated. Discussion of new multi-scale approaches at several length scales applied to nonlinear and heterogeneous materials have been emphasized from different related disciplines including metal physics, micro-mechanics, as well as mathematical and computational mechanics.

The editors wish to thank all authors for their contribution and the reviewers for their valuable comments and recommendations. After the peer review process, 12 papers are finally presented in this book aiming to become a helpful and valuable reference in the field of mechanics for scientists as well as for engineers.

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