

Preface

This book has evolved from lectures on fracture mechanics and micromechanics which we held for students of engineering and materials science over the years. It is primarily meant as an aid for students learning the foundations of these subjects. At the same time this book may also serve as an introduction into these fields for researchers and practitioners in industry and to provide the theoretical background for solving respective problems.

The book covers the most important areas of fracture mechanics and gives an introduction into micromechanics. Our major concern was the presentation of principal concepts and methods in a clear and sound manner as a basis for a deeper entry into the matter. The presentation mainly focuses on the mechanical description of fracture processes; yet, material specific aspects are also discussed. To keep the text self-contained, continuum mechanical and phenomenological foundations are recapitulated first. They are followed by a brief survey of classical fracture and failure hypotheses. A major part of the book is devoted to linear fracture mechanics and elastic-plastic fracture mechanics. Further chapters deal with creep fracture and dynamic fracture mechanics. An extensive chapter treats foundations of micromechanics and homogenization. Finally, elements of damage mechanics and probabilistic fracture mechanics are presented. Suggestions for further reading are listed at the end of each chapter.

The first two editions were well accepted by the readers making a new edition necessary. We have again used this opportunity to completely revise the book and to incorporate a number of extensions. Among others, we have addressed topics such as the numerical treatment of crack and homogenization problems, cracks in anisotropic materials, periodic microstructures and the nonlocal regularization of damage models. Finally, some further examples have been added.

The authors are indebted to all who have contributed to this book. This particularly includes those from whom we have learned or, as Roda Roda has put it ironically: “Copying from four books yields a fifth profound book”. Special thanks go to Mrs. Dipl.-Ing. H. Herbst who has prepared most of the figures. Finally, the pleasant cooperation with the publisher is gratefully acknowledged.

Fracture Mechanics

With an Introduction to Micromechanics

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