Analysis of Cracks in Solids: Advances in Fracture Mechanics

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The need for progress in modelling and analysis of crack problems in solids has resulted in renewed attempts at using modern approaches to boundary value problems. By taking a different viewpoint on the traditional treatment of many problems, such as crack theory, the range that can be resolved through mathematical tools is enlarged. This book provides a fresh outlook on crack problems, displaying new methods of studying these and proposing new models for cracks in elastic and nonelastic bodies satisfying physically suitable nonpenetration conditions between crack faces. Two- and three-dimensional bodies, plates and shells with cracks are considered. Properties of solutions such as existence of solutions, regularity up to the crack faces, and convergence of solutions as parameters of a system are varying are established, while different constitutive laws such as elastic, thermoelastic and elastoplastic are also analysed. The new approach presented by the authors is intriguing because it fails to lead to violation of physical properties. In addition, the boundary conditions analysed are given in the form of inequalities, and are properly nonpenetration conditions of crack faces. This implies that similar problems may be considered from the contact mechanics standpoint. The contents are divided under the following headings: Introduction; Cracks in Plates and Shells; Cracks in Complicated Plates; Variation of Cracks in Solids; and Cracks in Elastoplastic Bodies.