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Book Reviews

Fracture Mechanics of Concrete: Material Characterization and Testing. Edited by A. Carpinteri and A. R. Ingraffea. Martinus Nijhoff Publishers, The Hague, 1984. 202 pages.

REVIEWED BY Z. P. BAŽANT[1]

Concrete structures are normally full of cracks, more so than structures of any other material, and the typical mode of failure of concrete is fracture rather than plasticity. Yet, fracture mechanics so far has not been introduced in standard specifications for concrete design. Its applicability has been doubted by concrete engineers, due to the fact that the linear elastic fracture mechanics was shown long ago to disagree with tests of brittle failures almost as much as the plastic limit analysis. Recent research, however, has shown that fracture mechanics formulations which take into account the nonlinear behavior in the fracture process zone and the distributed nature of cracking can be brought in good agreement with the test results. This has led in recent years to a tremendous surge of interest and intensification of research in the fracture mechanics of concrete. The present volume, which summarizes the recent research results, is thus a very welcome addition to the literature.

The book consists of six chapters. Chapter 1, written by G. C. Sih, deals with the mechanics of material damage in concrete, which is characterized chiefly by the material strain energy density function. Chapter 2, prepared by A. DiTommaso, discusses the evaluation of concrete fracture, its microscopic aspects as well as the consequences of cracking for stress-strain relations. Chapter 3, authored by S. Mindess, is the largest chapter which treats fracture testing of cement and concrete and discusses the physical phenomena involved in fracture, the rate of loading effects, notch sensitivity, the fracture toughness parameters and their measurement techniques, and the effect of specimen size. A valuable aspect of this chapter is an extensive and detailed summary of the concrete fracture test data available in the literature. An excellent historical review, documented by a set of 175 references, is also given in this chapter. Chapter 4, written by S. P. Shah, analyzes the dependence of concrete fracture toughness on specimen geometry and composition. This chapter presents a lucid and thorough discussion of the resistance curves and their measurement techniques, proposes a theoretical model for the nonlinear fracture process zone, and gives many comparisons with test data. Fracture of fiber reinforced concrete is also discussed and a new model is presented. Chapter 5, by F. O. Slate and K. C. Hover, deals with microcracking in concrete, discussing the microscopic observations of microcracks as well as their effect on the properties of concrete, with particular attention to the differences between high strength and low strength concretes. Finally, Chapter 6, prepared by P. Jacquot, addresses the specialized field of interferometry measurements in scattered coherent light, which has emerged as an important technique for observing the deformations in the cracking zones. Fracture analysis of structures and numerical calculations are not covered in the present volume, since they are treated in a subsequent companion volume written by another set of experts under the editorship of G. C. Sih and A. DiTommaso.

The book represents a collection of very valuable authoritative articles on various aspects of material characterization and fracture testing, rather than a unified and coherent treatise. The individual chapters sometimes overlap in the subject matter covered, and sometimes offer different opinions on the same subject, which might leave a student bewildered. This is, however, inevitable when individual chapters are prepared by different authors. The book, nevertheless, presents an outstanding exposition of the current research and the latest results. It is a reference volume which is highly recommended to researchers, teachers, and graduate students in the field of fracture mechanics, and it should prove useful to concrete engineers as well.

Dynamics of Rotors – Stability and System Identification. Edited by O. Mahrenholtz. Springer-Verlag, Wien New York, 1984. 511 pages. Price $37.40.

REVIEWED BY S. L. HENDRICKS[2]

This book contains the lecture notes presented at the course *Dynamics of Rotors* held at the International Center for Mechanical Sciences (CISM), Udine, in October, 1980. Contributors include: J. Drechsler; L. Gaul, B. Grabowski; O. Mahrenholtz; R. Nordmann; Z. A. Parszewski; N. F. Rieger; V. Schlegel; and H. Springer. As a collection of lectures, the book is tutorial in nature and is presented without trying to intimidate, although some familiarity with the equations of rotor dynamics is assumed. The book begins with a lucid discussion of Modal Analysis. Later topics include: various types of bearings; sources of instabilities; rotor-support interactions; balancing; vibration measurement; parameter identification; crack effects; turbine blades; and torsional vibrations.

Part I – Modal Analysis in Rotor Dynamics. This section contains one paper which introduces the study of rotor dynamics via modal analysis. The matrices which describe the motion of rotating machinery are asymmetric and speed dependent. To decouple the equations of motion requires complex eigenvalues and eigenvectors. These are developed and the author gives a qualitative feel for their interpretation.

Part II – Dynamic Behavior of Rotors. The ten papers

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