

Book Review

Structure, Solid Mechanics and Engineering Design

Proceedings, in two volumes, of the 1969 Southampton Civil Engineering Materials Conference

Editor M. Te'eni

Wiley-Interscience, New York (1971), 1445 pp. with index

This is not a book that can be reviewed in the usual sense, consisting, as it does, of some 106 review and research papers together with edited discussions: most comments that one could make would reflect on the original conference rather than on these published proceedings. The stated aims of the conference itself have been made clear by the editor. Its purpose was to attempt to consolidate the present state of knowledge and current hypotheses concerning the relationship between the mechanical behaviour of some common structural engineering materials and their microstructures; to consider the application of such knowledge to engineering design; and to provide a platform for the interdisciplinary exchange of ideas. A study of the names and affiliations of the delegates, the wide range of material presented in the papers, and the actual exchanges in the discussion periods indicates to one who did not attend the conference that these objectives were probably more than satisfactorily achieved, although any thoroughly conscientious delegate must have found himself rather exhausted by the end of the conference.

These conference proceedings are sub-divided into sections in such a way as to present the material on three levels, beginning with the microstructural and micromechanics approach, followed by the observation and prediction of behaviour on the laboratory scale, and leading finally to the macroscopic levels inherent in design philosophy. The emphasis is, as the editor indicates, on general phenomena rather than on specific systems. But the behaviour of a wide range of materials is discussed, and the list includes soils, rocks, plain cements and concretes, bituminous materials, timber, solid and foamed plastics, and composites of many kinds, including particulate and fibre-filled plastics, and fibre-strengthened cements. The contents of the separate sections may be roughly identified in the

following way. Section 1 contains three introductory articles on deformation and fracture in relation to microstructure and the analysis of real microstructures in terms of simple and complex constitutive laws. Section 2 contains twelve papers on the general phenomena associated with internal structure and micromechanics, including analysis of stresses in non-homogeneous and cracked bodies, size effects, and the characterization of random structures. This is mainly a theoretical section, whereas section 3 contains twenty-two papers on micromechanical behaviour of specific engineering materials, with some emphasis on fibre reinforced systems. In section 4 there are ten papers on the theoretical rheology of materials under load. Particular attention is given to continuous and discontinuous systems under simple and complex stresses, and viscoelastic behaviour.

Section 5 contains twenty-three papers on deformation and creep in a variety of materials, both experimental and theoretical studies, and in section 6 there are a further nineteen papers on failure theories and design criteria. Between sections 5 and 6 there is a clear transition from the microscopic to the macroscopic level. In section 6 are discussed the plain fracture, under tensile, compressive, shearing, and complex stresses, fatigue failure and cumulative fatigue damage, of rocks, soils, and plain and reinforced cements. Section 7 is a general discussion session, and in section 8 are the final seventeen papers on the application of some of the foregoing ideas to engineering design, a treatment at the fully macroscopic level of the behaviour of structural components rather than material systems, and the relationship of material properties to design and the performance of actual structures.

The Discussion sessions at this conference were initiated by means of the much debated rapporteur system – probably the only way of dealing with such a quantity of papers. The usefulness of this method depends, naturally on the rapporteur himself, but in the published proceedings the rapporteurs' contributions may be said to occupy expensive type-space rather needlessly since the reader has the original papers in front of him. Much of the rapporteurs' introductions were, in any case, a simple statement of what the papers contained, and it will be an enthusiast

indeed who decides to devote time to these introductions in the hope that they contain some otherwise undetected gem. These volumes contain an index constructed from key words provided by the authors, and incomplete as it may be, this is nevertheless a most useful addition.

This publication will undoubtedly be of considerable importance to all engineers and materials scientists interested in the vital relationship between material properties, microstructure, and engineering design.

B.H.

Differential Thermal Analysis

VOLUME 2 APPLICATIONS

edited by **R. C. Mackenzie**

*The Macaulay Institute for Soil
Research, Aberdeen, Scotland*

December 1972, xvi + 608 pp., £12.50

This work, Volume 1 of which has already been widely acclaimed as a definitive text on the subject, brings together contributions by international experts to give an authoritative, critical assessment of the present position concerning fundamentals and

applications in DTA. Not only is definitive data given for a very large range of compounds and materials but the processes which occur on heating are discussed in detail and the effects of various, often little appreciated factors on DTA results are assessed. Volume 1 dealt with general aspects, inorganic and organic materials. The present volume supplements this information by describing applications in physical chemistry, industry and technology which in many instances it would have been difficult to deduce from Volume 1.

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24-28 Oval Road, London NW1, England
111 Fifth Avenue, New York, NY 10003,
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