included in what could be called the packing anisotropy of the granular materials. This suggests a need for a distinction between packing produced by processes about which we have some knowledge and packing which occurs in naturally occurring media, for which the processes involved in determining packing are largely unknown. But gravity certainly must play a role. In addition to the packing anisotropy, Oda discusses orientation anisotropy induced by the nonsphericity of the grains. It is the latter type of anisotropy which is usually considered in continuum models of liquid crystals and anisotropic fluids, for example. Other papers in this first area discuss experiments which determine particle forces and fabric quantification photoelastically, the effects of inherent anisotropy on stress deformation characteristics of sand, and the effects of small, triaxial "prestress" on the subsequent development of pore water pressure in undrained triaxial shear of sand. Fabric identification and measurement occupies approximately one quarter of the proceedings.

The second broad category described in these proceedings involves statistical approaches to granular materials. The papers here assume a background which is somewhat more specialized than that needed to appreciate the rest of the proceedings. Beran's *Statistical Continuum Theories* could be used to acquaint oneself with the use of statistical concepts in continuum mechanics.

The last group of papers is devoted to continuum approaches and occupies approximately one half of the proceedings. For the solid-like behavior, the theory of Goodman and Cowin is elaborated upon by several authors. In this theory, porosity and porosity gradient are used as measures of fabric and the porosity satisfies its own equation of equilibrium, as in the equilibrium of the orientation vector in a liquid crystal. Cowin brought up the question of identifying the best measures of local fabric in continuum theories and noted that the strong dependence on contact normals observed by Oda must be accounted for. Mullenger suggested that fabric could be characterized with a symmetric second-rank tensor, in analogy to that used for anisotropic fluids, as proposed by Hand in 1962. Elastic-plastic and rate-independent continuum theories of granular materials were also given.

In the continuum approaches to fluid-like behavior, both experimental and theoretical papers were given. Experiments by Savage indicate that, in shear flow between concentric rotating cylinders, shear stress appears to be proportional to the square of the shear rate, and that the stress depends on particle size and the curvature of the cylinders. Umeya's work describes powder-liquid systems in which the behavior is analogous to a fluid suspension. Papers were presented on theoretical aspects of fluid-like behavior based on the model of flowing granular materials developed by Goodman and Cowin in 1971.

The mechanics of granular materials as exemplified by these proceedings is in its infancy in comparison to the mechanics of, for example, the elastic solid and viscous fluid. Interesting as they are, the experiments involving the measurement of fabric of simple models of granular materials are not easily generalized into bulk continuum models. Professor Cowin's challenge to establish the second best measure of fabric for continuum purposes is, therefore, left unanswered. These proceedings provide an up-to-date account of the challenges and frustrations involved in developing an inclusive theory for granular materials.

Les instabilités hydrodynamiques en convection libre, forcée et mixte. Edited by J. C. Legros and J. K. Platten. Number 72 in Lecture Notes in Physics. Springer-Verlag. 1978. Pages 202. Price $12.40.

REVIEWED BY S. LEIBOVICH[6]

This is a series of 18 (most rather short) papers, 11 in French and 7 in English, presented at a Colloquium at the Ecole de Thermodynamique de Bruxelles in April, 1977. The papers, which deal with a wide variety of convective instability problems in fluid dynamics, are loosely arranged in three sections: (*A*) pretransitional effects and study of the critical point (for instability), (*B*) study of convection in Newtonian fluids, and (*C*) stability of non-Newtonian fluids. Experimental, as well as theoretical and numerical works are included, although the majority of the work represented is theoretical in nature.

Section *A* contains six papers on kinetic theory, on the effects of thermal fluctuations on macroscopic behavior near a bifurcation point; and the stability of liquid mixtures, of fluid in porous media, and water-ice interfaces.

Section *B* contains nine papers on convective stability of Newtonian fluids, including magnetohydrodynamic and electrical applied forces, double-diffusion phenomena, and other effects.

The three papers of Section *C* concern nematic liquid crystals and viscoelastic liquids.

The range of physical and chemical phenomena affecting the stability of fluid motion and covered in these lectures is very impressive. This book, serving as it does as a collection of such interesting phenomena, will be a valuable addition to technical libraries, although few are likely to add it to their personal collections.

Wear. Treatise on Material Science and Technology. Edited by D. Scott. Vol. 13. 1979. Academic Press, Inc., New York. Pages 498. Price $49.50.

REVIEWED BY F. F. LING[7]

This volume contains the articles: Theories of Wear and Their Significance for Engineering Practice by F. T. Barwell; The Wear of Polymers by D. C. Evans and J. K. Lancaster; The Wear of Carbons and Graphites by J. K. Lancaster; Scuffing by A. Dyson; Abrasive Wear by M. A. Moore; Fretting by R. B. Waterhouse; Erosion Caused by Impact of Solid Particles by G. P. Tilly; Rolling Contact Fatigue by D. Scott; Wear Resistance of Metals by T. S. Eyre; and Wear of Metal-Cutting Tools by E. M. Trent.

In this effort editor D. Scott has made a superb selection of authors, each an authority in his field. And, I find, collectively, each/each team has/have done justice to the literature while providing very readable exposition to a given area. The illustrations are pertinent and adequate; a feature so important to the field of wear where knowing the phenomena is still a big part of the solution sought. This volume includes a subject index.

Stress Analysis of Notch Problems. Edited by George C. Sih. Noordhoff International Publishers, The Netherlands. 1978. Pages 312. Price $37.50.

REVIEWED BY R. MUKI[8]

This book is the fifth volume of *Mechanics of Fracture* edited by G. C. Sih. The introductory and four chapters are: Strain-energy density and surface layer energy for blunted cracks or notches by the editor; Solutions of notch problems by body force method by H. Nisitani; Analysis of notches using conformal mapping by O. L. Bowie and C. E. Freese; Stress analysis of edge notches by Chih-Bing Ling; and three-dimensional notch problems by M. K. Kassir. Each contributor presents fundamental concepts and methods of analysis pertinent to each topic. The articles by Nisitani and by Bowie and Freese contain a number of well-documented tables and figures exhibiting stress-concentration factors and stress-intensity factors for

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