On a number of subjects the author advances and justifies his own original viewpoint. Even though some of them remain debatable, it will stimulate progress in this field of science, foster better understanding of the complicated phenomena of hydrodynamics and heat transfer in a fluidized bed and in other fluid–solid systems considered.

The author has aimed at the difficult task of providing different specialists with a guide to conscious and creative application of fluidization in their field. He has largely succeeded thanks to his permanent desire to penetrate the mechanisms of complicated phenomena and to convey them with sufficient simplicity.

Model (analogy) presentation and, on its basis, analysis of experimental results allowed the author to separate main things from minor ones, systematize and explain a great deal that had previously appeared anomalous.

The book is notable for progressive exposition of the material. The book starts with a discussion of the fixed bed and fluid flow through it. This is followed by consideration of the onset of fluidization for fixed and moving beds. The author presents also an original approach to the problem of an inlet distributor design.

An original expression is derived for the efficiency of lifting of solid material by means of fluidization. The expansion of particulate and aggregative fluidized beds is considered. The causes of irregular change in fluidized bed non-uniformity with increasing fluid velocity are analysed, and the author explains the re-appearance of bed uniformity at high fluid velocities.

An interesting suggestion is advanced in which the mechanism of particle separation by their size in uniform and non-uniform fluidized beds is revealed.

Brief mention is made of a suspended bed, i.e. a system that follows a fluidized bed at high fluid velocities, and a "falling" bed. The author shows the dependence between choking velocity of the vertical pneumatic conveying and feeding rate of material. The causes are explained and the conditions of unstable operation of a "falling" bed are shown.

Further, when studying a spouted bed, the author draws a generalized analogy with channeling at fluidization.

Elutriation from a fluidized bed is a phenomenon of great importance in the practice of industrial fluidization. The experimental data are analysed in the light of a more basic idea of the mechanism of the process.

The author offers a convincing solution to the most intricate and principal problem of heat transfer between particles of a fluidized bed and the surrounding medium. He explains the possibility of combining the classical idea on rather high minimum values of Nu for a particle with very low effective values of Nu for fine particles obtained in experiments on measuring mean fluid and solid temperatures. He suggests and justifies the idea of the most significant role of micrononuniformity of fluid distribution in a bed, flow "microbreaks" confined to small regions in a bed. The importance of slight invisible aggregation of particles is shown. A means of intensifying heat transfer between a gas and particles of a fluidized bed are outlined. The reason for the lack of good correlation of the type $Nu = f(Re)$ for agreggative fluidized beds is explained.

The data available on the effective heat conduction of fluidized beds are analysed, and recent advances in this field made by the author's research group are briefly covered.

Full consideration is given to the important problem of heat transfer between a fluidized bed and a heating (cooling) surface immersed. With the help of the model proposed, theoretical expressions have been derived for the heat-transfer coefficient of a uniform fluidized bed. The analysis of experimental data proves these theoretical expressions to explain many results obtained in experiments on aggregative fluidized beds. For a more profound analysis of heat transfer between an aggregative fluidized bed and heating surfaces, the author has suggested a more adequate theoretical model than those available, that takes into account particle diameter in aggregates (packets).

Conception on effective porosity of an aggregative fluidized bed has been introduced and justified as a measure of relative contacting time of a heating surface with pure fluid (discontinuous phase). A simple experimental way of determining effective porosity is demonstrated.

Fresh experimental data obtained by the author's coworkers on some interesting details of heat transfer between an aggregative fluidized bed and heating surfaces is cited: as on cavity formation at one side of horizontal and vertical tubes immersed in an aggregative fluidized bed. Frequent agreement in average values of the heat-transfer coefficient in spite of great divergence of local values is revealed.

The concluding chapter of the book meets the demand for overcoming the shortcomings of fluidization as a technological method, or, as the author points out, it shows how the characteristics of a fluidized bed can be altered at will.

S. S. Zabrodsky's monograph is also valuable because it provides an excellent systematic survey of present-day knowledge in this field, information which is scattered throughout the scientific literature and, mainly, periodicals. Original solution of a number of important problems is of great interest.

The book is therefore a valuable contribution to the heat- and mass-transfer theory of dispersed media.

This is a book which can be recommended for translation into English.

A. V. LUIKOV

Proceedings of the 1963 Heat Transfer and Fluid Mechanics Institute: Ed. A. ROSHKO, B. STURTEVANT and D. R. BARTZ. Stanford University Press. 288 pp. 70*s*.

THIS volume contains a collection of eighteen papers presented to the sixteenth annual meeting of the Heat Transfer and Fluid Mechanics Institute, which was held between 12th and 14th June 1963 at the California Institute of Technology. The papers include new and basic contributions to fluid mechanics and heat transfer, and the related fields of mass transfer and combustion. Emphasis is given to topics which have broad implications and which, therefore, may not fall readily into any one of the conventional areas of engineering. While most of the material is from North American sources, a European flavour is introduced by including papers from authors normally resident in Germany, Great Britain and France, the latter contribution being written in French. The reviewer welcomes and would wish to encourage this trend towards an international selection of papers.

Many of the topics have applications to problems likely to arise in high-speed flight or in space. Among these are four papers, one dealing with the influence of thermal radiation on the structure of a normal shock wave, and a second which is concerned with one-dimensional energy transfer between two walls separated by a radiating and conducting gas. The third paper considers heat transfer by simultaneous conduction, convection and radiation due to the one-dimensional flow of a grey fluid through a porous bed, while the fourth is a study of the interaction of high temperature argon with the end wall of a shock tube, both convective and radiative heating being taken into account.

Three further papers are concerned wholly or in part with flows in which there is chemical reaction. An examination is made of the use of reference-state expressions and constant-property solutions in predicting transport rates in flows of variable-property fluids with mass transfer. A modified theory is presented for the effect of surface temperature on the combustion rate of carbon surfaces in air. The third paper describes an investigation of the thermal ignition of flowing combustion gases in contact with heated, non-catalytic and non-reactant bodies.

Five papers can be grouped under the general heading of fluid mechanics. Using the hydrogen-bubble technique, an excellent flow visualization study has been made of the details of the transition mechanism in a thick boundary layer. A two-parameter method of solving the laminar boundary-layer equations for shock-wave boundary-layer interaction is presented, in which separated-flow regions are also considered. In a third paper, closed-form solutions are obtained to the hypersonic viscous layer with finite-rate chemistry in the vicinity of a spherical stagnation point. The fourth paper deals with the displacement of a viscous fluid from a porous medium by another fluid with which it does not mix. Perhaps one of the most interesting papers describes a theoretical and experimental study of the compressible flow of an air–water mixture through a convergent–divergent nozzle.

The remaining papers fall broadly in the category of convective heat-transfer. The first presents heat-transfer measurements for a vapour condensing on the outer surface of a rotating cylinder. In the second, a theoretical study is made, using energy considerations, of the growth and collapse of vapour bubbles in a subcooled liquid on a boiling surface. The French paper describes the visualization of natural convection by differential interferometry in the transitional and turbulent regimes. There are three papers which deal with forced convection; one is concerned with the interaction between the heat transfer and a developing hypersonic laminar boundary layer under a highly favourable pressure gradient. In another paper, measurements of local heat-transfer coefficients are given for the turbulent forced convection of hydrogen and helium in a tungsten tube at surface temperatures up to 5600°R. Finally data are presented for turbulent-forced-convection heat-transfer in eccentric annular passages.

It will be seen that the material covers a considerable area of investigation. The selection made does, however, involve some imbalance between theoretical and experimental researches, the ratio being roughly two to one in favour of the former. The reviewer would have preferred to see more papers in which theoretical and experimental studies were complementary. These are not necessarily criticisms of the committee, whose members are governed by the material submitted and must choose accordingly. It may simply be that insufficient experimental research of the requisite significance and quality is being undertaken. Nowadays, when the volume of published work in fluid mechanics and heat transfer is so large, and is increasing, so we are told, exponentially, there is much to be said for the collection of papers in book form. This is particularly true, when, as in the present volume, an effort has been made to select the most significant and best written papers, and to publish them almost immediately after the annual meeting. The method of reproduction employed, which utilizes the original manuscripts, is clearly of great assistance in this respect, and ensures that errors are kept to a minimum. The editors are to be congratulated on the general clarity and consistency of presentation.

B. W. MARTIN