the theories are examined critically to see to what extent they agree with practice. This is refreshing as far as books in English are concerned since there has been a tendency for theory and experiment to develop far too much in parallel – both going on to infinity but never meeting! This has been a particular danger in the field of turbulence and Branover's personal contributions to the experimental study of MHD turbulence make him an especially appropriate author for such a text; this particular topic is examined at length.

Little attention is devoted to problems of heat (and none to mass) transfer to the duct walls. The various boundary layers (Hartmann or shear) are studied in great experimental and theoretical detail (rectangular vs circular ducts, conducting vs insulating walls, smooth then rough boundaries, flows along and across the field, onset and suppression of turbulence, etc., etc.) but almost invariably to establish flow geometry (velocity variations, boundary layer thicknesses, etc.) and momentum transfer in terms of the friction factor or drag coefficient (which are interchangeable as far as Branover is concerned).

Only about seven pages out of 290 are concerned with heat transfer. This would not perhaps matter, if the Reynold's analogy applied since heat transfer rates would then follow the friction factors that are so fully discussed. Unfortunately, at low Prandtl numbers, e.g. in liquid metals, the situation is distorted by metallic thermal conduction. (Branover calls it "molecular", but he must mean "electronic") and the discussion becomes more qualitative. Only the principal features of heat transfer in the presence of a magnetic field are mentioned (the importance of Joule heating with an external circuit or conducting walls, the equally important generation of heat in thin shear layers at high Hartmann numbers). The amount of experimental data is limited – and indeed experimenters usually put a great deal of effort into maintaining temperatures constant to within one or two degrees around the entire loop. So not much here for the heat and mass transfer man.

All in all, this is a book only for the specialist, despite its claim to be "also for engineers and students, who may well be encountering magnetohydrodynamics for the first time". To avoid misunderstanding, "Incompressible" should be included in the title. But for anyone in the business of liquid metal loops or incompressible MHD duct flows this book will undoubtedly be required reading.

D. T. Swift-Hook

E. F. Nogotov, **Applications of Numerical Heat Transfer,** McGraw-Hill, New York. 142 pp.

This book originally published by UNESCO, is based on a series of lectures given by the author in the U.S.S.R. in 1974. It deals with applications of finite-difference methods to problems in conduction and convection.

There are three main sections. Firstly, basic concepts are covered, including the topics of convergence, stability, stability analysis and alternative finite difference approximation formulae. Then problems in heat conduction are analysed ranging from simple one-dimensional cases, through boundary condition approximations to three-dimensional and variable property cases. Finally, the approach to a limited range of convection cases is specified.

The book has a number of attractive features, which unfortunately are counterbalanced by more prominent drawbacks. Thus the material has the pleasing quality of requiring about the same level of understanding all the way through, rather than over-explaining the simple and vice versa. But the layout comprises long sections uniformly presented (for example, the six-page section introducing stability and convergence), so that the beginner would have difficulty discerning the more important "trees" in a given "wood".

The author's experience and expertise, and the research material to which reference is made, are all evident; expressions such as "may be recommended" are common, and there are a number of practical hints in the Conclusion. It seems a pity, therefore, that this expertise is not reflected in some judiciously selected results, tables or graphs, which in fact are completely lacking; they could readily have been included for the simpler conduction problems.

Finally, the convection section is substantially deficient for "engineers working in the energy field" for whom the book is written. The words laminar and turbulent appear to be totally missing! This is because applications are biased to free convection with a maximum specified Reynolds number of 100 (p. 110), although there is a vague reference to "approximated viscosity effect" (p. 117) for high-rate processes. Hence there is no discussion of turbulence modelling.

To sum up, the book does not appear to satisfy the claim in the Preface to be a "complete ... treatment of the subject". However, despite the above criticisms, the book has definite attractions which make it worthwhile as, perhaps, a second textbook on the subject.

M. W. Collins

J. Kestin, **A Course in Thermodynamics.** Vols. I and II. McGraw-Hill, New York. 725 pp. and 617 pp.

Teachers of thermodynamics will be pleased that it is again possible to obtain copies of Professor Kestin's erudite two-volume treatise. It is a work of substantial scholarship to which teachers and advanced students of science and engineering can turn for a rigorous exposition. In it they will find a discussion of all those logical difficulties which are glossed over in introductions to the subject. Furthermore, as befits a treatise rather than a textbook, adequate reference is made to the historical development of the subject. In the preface to the second printing, the author acknowledges that it is too abstract an approach for the stomach of most undergraduates, and certainly it uses mathematical tools likely to be in the hands only of postgraduates. Nevertheless, the exposition follows in the mainstream of current approaches to the subject, and no great reorientations of the mind are necessary to follow the argument.

Volume I deals with units and concepts, equations of state, First and Second Laws, and the behaviour of a comprehensive range of thermodynamic systems including electrical and magnetic systems. That it takes over 700 pages to cover this basic material is sufficient indication of the depth of treatment.

Volume II treats of more advanced topics, beginning with a full discussion of equilibrium including its use as a unifying principle by Hatsopoulos and Keenan. This is followed by an introduction to statistical thermodynamics and quantum mechanics and their application to the properties of perfect gases and perfect crystals. It goes on to deal with the behaviour of a pure substance in a single phase, and chemical equilibria in a single phase and in heterogeneous systems; and ends with a full treatment of the Third Law and irreversible processes in continuous systems. Designers of courses in advanced thermodynamics will have no need to look further than this volume for adequate material.

Whether it is a criticism of the author or the publisher, it is sad that the opportunity has been missed to shorten the section on units by introducing SI. The old definition of the mole and the unit symbol °K are still in evidence. The author may have regretted quoting the, by now, obsolete IPTS-48 in full; surely an easily up-dated reference would have been sufficient. Similarly it might be argued that the section on practical temperature measurement is superfluous because there are adequate specialised texts on the subject. Tables of properties, which occupy 90 pages at the end of Volume II, are