BOOKS

The Method of Weighted Residuals and Variational Principles, Bruce A. Finlayson, Academic Press, New York (1972). 412 pages.

This is an excellent book for the engineer or applied mathematician interested in solving virtually all types of differential equations in fluid mechanics, transport phenomena, reaction kinetics, and hydrodynamic stability. It is written at the level of a first-year graduate student with a good knowledge of differential equations and some facility with numerical methods. It is probably too specialized to serve as a one-semester course textbook but is well suited to serve as a supplementary reference for courses in approximate methods and as a reference for people involved in solving differential equations. The bibliography is quite extensive and many exercises with solutions are presented. One minor drawback has to do with the order of presentation. In a few instances, it is necessary to jump ahead several sections to read up on background material.

The methods of weighted residuals and variational methods have been in use for some time by workers in fluid mechanics, physics, stability, and heat transfer. Applications in chemical engineering have recently begun to gain in popularity, especially in the areas of transport phenomena and kinetics. Linear and nonlinear problems involving two-point boundary values, recycle streams, or in which good physical insight into the shape of the solution is available have been treated with facility. However, the suggestion on the book jacket that it would benefit researchers in the computer science who deal with automata theory, artificial intelligence, function approximation, and the like may be stretching a little.

The author gives a clear exposition of what methods to use for what types of problems and how to go about choosing the approximation functions. The inclusion of material on error bounds should help to overcome the usual objection that the accuracy of an approximate solution is very difficult to ascertain. In addition, results from the author are presented showing that Galerkin's method is equivalent to the quasi-variational methods proposed for systems with time dependent, dissipative, or inertial terms. Thus, the additional complexity of using a variational principle is seldom justified for such systems.

LeRoy L. Lynn
Carnegie-Mellon University
Pittsburgh, Pennsylvania

The Rheology of Lubricants, T. C. Davenport, (Ed.), Halsted Press, New York (1973). 138 pages. $13.75.

The papers in this volume range from a discussion of Cauchy-Green tensors to empirical results obtained in cold-room testing of automobile engines, and in humor (humour) from wry ("we have no car engines, we simply read the literature") to dry ("bearings run without any lubrication suffer a high rate of wear"). They represent a commendable and readable attempt to cover the subject in its entirety. This is especially timely in view of the pathological state of rheology at the present time.

The introductory paper by K. Walters is a readable, deep, and sensitive overview of rheology in general. The study of lubricant behavior in journal bearings by Davies and Walters is likewise a sensitive analysis in which the physics is described as clearly and accorded as important a position as is the mathematics. Hopefully, it will set the tone for continuing analytic studies in this area. Not surprising to anyone familiar with J. F. Hutton's prior experimental studies (at Shell), his two contributions on lubricating oils and greases are likewise exemplary and provide an improved variety of challenges for analysts. R. F. Pywell (employed, as is the editor, by British Petroleum) provides extensive new high pressure viscosity data.

To be sure, there are also disappointments. The paper on carbon-black filled oils attempts to treat an area of endeavor in which colloidal structures are important and have received much study without any reference to this extensive background. The paper grandly entitled "Biotribology" is trivial biologically and naive tribologically.

Overall, this volume is a welcome experiment to getting rheologists to orient their work toward something useful. We can use further symposia in a variety of engineering areas with similar objectives. The editor and publisher are to be complimented on their prompt publication of these proceedings of a symposium held in 1972.

Arthur B. Metzner
Department of
Chemical Engineering
University of Delaware
Newark, Delaware 19711

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fessor Dyer objects. In any case one ought to focus on the objectives of a given model which in this case was to determine whether heat leakage into the core could seriously increase drying times. While the neglect of bulk flow will alter the shape of the concentration profile in the dried region, heat leakage into the core depends only on the magnitude of the gradient at the subliming interface. Any errors here can be accounted for by altering the magnitude of Γ [Equation (21)] and observing the response of the model. This we did, with the results shown in Figure 2.

LITERATURE CITED

Fox, E. C., and W. J. Thomson, "Coupled Heat and Mass Transport in Unsteady Sublimation Drying," *AIChE J.*, **18**, 792 (1972).
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William J. Thomson
Union Oil Company of California
Research Department
Brea, California