which is another way of saying that in their philosophy, the scientific and the religious spirit are united in a common enterprise. Matter and spirit may be enemies, but they may also be allies. This is the message which Dr. Schilling seems to convey.

The Effects of Federal Programs on Higher Education. A Study of 36 Universities and Colleges. By Harold Orlans. 361 pp. The Brookings Institution, Washington, D. C., 1962. Paperbound $2.95, clothbound $5.00. *Reviewed by Sanborn C. Brown, Massachusetts Institute of Technology.*

A GIFTED popular writer with a flair for the sensational could use the material of this Brookings Institution study to write a devastatingly iconoclastic exposé of all the inherent weaknesses and blunderings of our present system of higher education in the United States. Based on an extensive study of a carefully selected cross section of universities and colleges in the United States, Harold Orlans reports his results in a most subtly destructive way.

The survey itself seems well designed to bring out the facts associated with the effects of Federal programs on higher education. The survey method was to mail out 6500 questionnaires to faculty members in three groups: (1) institutions receiving large sums from the Federal Government, (2) institutions receiving smaller sums from the Federal Government, and (3) good liberal arts colleges. Somewhat over 3500 questionnaires were sent to Group 1, about 2000 to Group 2, and about 750 to Group 3. The 15-page questionnaire asked not only for comments in broad categories but shades of opinion as well, the questions covering not only background information about the respondent, but his experience with Federal agencies, his opinion as to the quality of education at his institution, whether Federal financing of research tended to concentrate funds in well-known universities, the effect of class size and student contact interacting with research programs, and various questions on the method of teaching and the use of teachers in the respondent's particular institution. The questions are well designed, and anyone who has been active in the higher education scene in the United States will find that the results are not inconsistent with the expected patterns of behavior in various types of institutions. Data corroborating or falsifying one's intuitive feelings about these subjects are well worth gathering, and the tabulation of the answers to the questionnaires makes this book a most useful source of information, since the summaries and display of the answers to the questionnaires have been carefully done and reproduced in an informative and useful fashion.

The subtly destructive tone of the book comes about not from the factual material or the conclusions based directly on the answers to the questionnaire, but rather from a continuous and, to me, almost anti-intellectually biased editorial narrative which discusses the answers to the questionnaire in terms of interviews and comments with educators in all walks of life where the negative and problem-laden points of view are continuously emphasized. As I read page after page of comments solicited by the questionnaire or culled from speeches and papers, I could not help but be reminded of my many years' experience on a local school board. Month after month and year after year, the local newspaper columns carry letters to the editor complaining about and condemning inequities in our public school system. My telephone rings many times a week, heralding yet another justifiably distressed parent. The number of contented people who react in these public ways with approving and happy messages is minuscule. The vast majority of people are so satisfied that it does not occur to them to feel the necessity of reacting to the school board. So it is with Mr. Orlans and his editorial comments. Somehow he misses the basic good in the academic world, and I am only fearful that economy-minded, anti-intellectual forces in this country may use his presentation to weaken this basic good and to undermine the constructive forces at work in higher education as a result of our currently expanding Federal programs.

Numerical Solution of Ordinary and Partial Differential Equations. L. Fox, ed. Summer School Lectures (Oxford, Aug.–Sept. 1961). 509 pp. Pergamon, London, 1962. Distr. in US by Addison-Wesley, Reading, Mass. $10.00. *Reviewed by J. Gillis, Weizmann Institute of Science.*

THERE are two kinds of people who write books on numerical methods, viz., those whose normal occupation is with the numerical solution of problems and those who earn their place under the sun by talking about numerical analysis. It is in line with experience in so many other fields of human activity that the members of the first group write the more interesting books. Dr. Fox and his collaborators belong to this first group.

The book represents essentially the material presented at a summer school held in Oxford in 1961. The range of topics is wide and the emphasis throughout is on practical methods. There is a large section on ordinary differential equations followed by one on integral equations. The third section is an introduction to partial differential equations. Finally, special methods for handling partial differential equations are presented in Part 4, each illustrated by a particular application.

Part 1 is distinguished by the absence of the welter of different interpolation formulae, all equivalent, which make so many books on the subject unreadably irritating. The emphasis is on two main approaches, the Runge-Kutta and the predictor-corrector methods. There is a chapter on stability which makes no attempt at completeness but which does give a fairly good idea of how such questions can be tackled. There are also two useful chapters on Chebyshev methods.

Part 2, on integral equations, is mainly standard material. The chapter on singular and nonlinear integral

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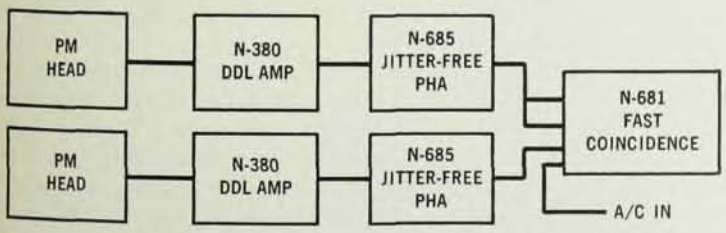

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equations is as scanty as our present state of knowledge of the subject; a few ideas about singular linear equations, and an explanation that nonlinear ones can be very difficult, except where iterative or linearization methods happen to work. The section ends with two extremely interesting and important chapters, one on the integro-differential equations which occur in nuclear collision problems and the other on the Hartree-Fock equation. Part 3 is all fairly routine but is animated throughout by the principle of how to find the most efficient way to solve specific problems.

Part 4 is the one that will interest advanced readers. It is an extremely useful collection of short accounts of various practical problems and their numerical solutions. The range includes nuclear reactor problems, Monte Carlo methods in neutronics, plasma problems, and numerical weather prediction, to name only a few typical examples. And the real value of these accounts is in the fact that they were written by those actually concerned with the problems and who are therefore best qualified to expound their essential difficulties.

Théorie des Groupes en Physique classique et quantique. Vol. 1, Structures mathématiques et Fondements quantiques. By Théo Kahan et al. 664 pp. Dunod, Paris, 1960. 75 NF. *Reviewed by Nicholas Chako, Queens College.*

IF one defines group theory in rudimentary terms as the study of order, symmetry, and other common characteristics of objects and especially geometrical forms, then its history is as old as geometry and inseparable from it. The early manifestations can be traced back to the handiwork of primitive man, i.e., in the designs of ornaments and pottery and in regular geometrical patterns pleasing to the eye. Indeed, Nature displays a great variety of symmetrical forms, in both the living and inert states, which underly the group idea. As man advanced in civilization, the symmetry principle found applications in the creative arts, as seen in the great temples and palaces. Along with these advances, there was a great development in speculative and abstract thinking about natural and spiritual phenomena, originating from a desire to understand and harmonize the physical and human phenomena. As a result, science and philosophy developed, and became disciplines in the education of civilized societies. Mathematics was the most successful of the sciences, and with its development, the principle of symmetry, embodied in the idea of a group as we know it today, took a definitive form in the hands of Plato, Euclid, and other Greek thinkers.

However, in the strict mathematical sense, group theory has a more recent origin. One could, perhaps, assign its origin to that tragic figure, Evariste Galois (1811–1832). Even so, the profound ideas and implications contained in Galois' work were not clearly understood by his contemporaries, whereas systematic studies of applied group theory were carried out by crystallographers, especially F. Neumann, Bravais, and