of parabolic type and their convergence. The discussion is largely related specifically to the heat equation, with extensions to other equations noted. Philip Davis and Philip Rabinowitz survey selected aspects of least-square approximation and give some numerical results. Among the topics considered, necessarily briefly, are basic orthogonalization theory and methods, approximation of functions, solving differential equations, and convergence. Kenneth Shoulders gives a detailed, largely qualitative presentation of microelectronics, including material deposition, micromachining, component interconnection, and electron optics. It is noted that computer-controlled electronic construction processes will be necessary to produce the tiny but complex computing machines of the future. Saul Gass outlines several areas of recent progress in the increasingly important field of linear programming. Topics included are integer linear programming, the multiplex method, gradient method, and computing codes. Robert McNaughton discusses automata, defined rather broadly to include any finite system whose outputs are determined by its inputs. Many types of automata are mentioned, such as Turing machines and less well-known concepts.

The microelectronics chapter is descriptive, the automata chapter is philosophical, and the others are mathematical; all are interesting and well written.

The Quantum Mechanics of Many-Body Systems. By D. J. Thouless. Vol. 11 of Pure and Applied Physics, edited by H. S. W. Massey. 175 pp. Academic Press Inc., New York, 1961. $5.50. *Reviewed by R. W. Hellwarth, Hughes Research Laboratories.*

TO derive from first principles the properties of many-body systems whose behavior can only be understood in terms of quantum mechanics is a large undertaking. It is no surprise that the remarkable, if only partial, successes in understanding many-body systems have come mainly through physical insight gained from experiment and coupled with mathematical ingenuity, rather than from any organized body of theory. Nevertheless, formalisms for the systematic calculation of many-body problems have been developed (spurred perhaps by the successes of quantum-electrodynamic theory) which have served to clarify and unify (and occasionally confuse) many-body problems. In *The Quantum Mechanics of Many-Body Systems*, D. J. Thouless surveys the formalisms and physics of systems of many identical particles, rederiving old and new results and discussing the approximations required by the various methods. The development of each subject is traced from first principles, but with rigor and detail generally sacrificed for clarity. Qualitative and classical results are often rederived to illuminate the implications of the quantum mechanics and establish a physical feeling for the problem. The book therefore serves as an excellent bridge from "elementary" statistical mechanics to the current sophisticated methods of diagram summation, Green's functions, etc. Moreover, Thouless dwells at most length on subjects that have not been treated in review elsewhere, referring the reader to other more complete discussions when duplication would involve lengthy digression. All but a few pages are devoted to systems of many identical fermions, although the alteration of formulae required to treat bosons is indicated in a general way whenever it is convenient. Exposition of the mathematical framework for treating such subjects as low-lying excited states, collective motion, and finite temperature effects is everywhere interspersed with the actual calculation of results for electron gases, superconductivity, nuclear models, etc. It is gratifying to find difficulties, unclear points, and unsolved questions constantly pointed out. The result is a volume which is a clear review of and a useful guide through a fast moving field of considerable theoretical complexity.

Dispersion Relations and the Abstract Approach to Field Theory. Lewis Klein, ed. Vol. 1 of Internat'l Science Review Series. 273 pp. Gordon & Breach, Publishers, Inc., New York, 1961. $4.95. *Reviewed by Freeman J. Dyson, Institute for Advanced Study.*

THIS book is an anthology of recent original papers in the more mathematical and axiomatic parts of quantum field theory. The papers are well chosen, and together they lay out a logical path to be followed by anybody trying to work his way into the voluminous current literature of field-theoretical research. However, the book is spoilt by several serious faults which I will now discuss.

It is natural to compare this book with the "Series of Selected Papers in Physics," a series of volumes published by the Physical Society of Japan for the use of its members. Unfortunately, because of the protectionist policies of the American publishing industry, the Japanese series is not for sale in the United States. The volume under review is very similar to the volume *Theory of Elementary Particles, I*, in the Japanese series. The two collections have five papers in common.

Comparing the American with the Japanese volume, I find the American to be inferior in three major respects. (1) The American book is printed on a smaller page and on fuzzier paper. This makes the text, especially when it is reduced from the large page size of *The Physical Review*, aesthetically unattractive and difficult to read without eye strain. (2) The American publishers include no note of thanks or acknowledgment to the authors and journals from which they have taken their material. They did not in fact ask permission or even notify the authors that a reprinting was intended. The Physical Society of Japan has always been scrupulously courteous in asking and acknowledging such permission. (3) The American editor decided to have translated into English three papers which were originally published in German. The translations are so bad that they make these excellent papers almost unintelligible. The translators evidently know nothing of the

subject-matter (example: on page 169, "tempered distributions" are translated as "smooth distributions") and very little of the German language (example: also on page 169, "denn" which means "because" is translated as "then"). Such examples can readily be found on almost every page of the translated papers. Sometimes a sentence is so garbled that its meaning has been entirely lost (example: speaking of the reviewer, the translators write on page 170, "He replaces the original, not the elementary proof of the authors.").

In short, the book under review is a disgrace to American scholarship and to the American publishing industry. I believe it is an excellent thing if such collections of reprints, including translations, are made available to the public, provided that they are competently edited. But the public has the responsibility and the duty to make sure that the work of reprinting is not usurped by opportunistic and incompetent people.

Quantum Mechanics. By Eugen Merzbacher. 544 pp. John Wiley and Sons, Inc., New York, 1961. $12.00. *Reviewed by Stuart A. Rice, University of Chicago.*

MERZBACHER'S *Quantum Mechanics* is a very good introductory text arranged in canonical format. There is little that cannot be found in other texts, but the author has written a very readable and coherent account of quantum theory, in several cases bringing together topics usually separately treated. In particular, I found the treatments of scattering and of angular momentum particularly suited for a first course. The chemist will find, among other special subjects of interest, a concise and clear treatment of the double-oscillator problem, interesting comments on the violation of parity and a nice discussion of the Stark effect. Although the book contains more than enough material for a first course, it would have been advantageous to have included a chapter or two on quantum statistics and the basic ideas involved in the approach to the study of the many-body problem (i.e., resolvent operators, Hartree-Fock and Bruckner methods, etc.). Aside from this deliberate omission, the text can be unreservedly recommended for use in a first course in quantum mechanics.

Introduction to Mechanics, Matter, and Waves. By Ugo Ingard and William L. Kraushaar. 672 pp. Addison-Wesley Publishing Co., Inc., Reading, Mass., 1960. $9.75. *Reviewed by M. W. Friedlander, Washington University.*

FOR a considerable time we have been in possession of a comprehensive view of physics and have realized the importance of many very general principles which tie together topics otherwise apparently unrelated. We have also been prepared to change very radically our descriptions and views when the weight of experimental data so indicates as, for example, following the asymmetries observed in some interactions, which are ascribed to a nonconservation of parity. Considering all of this, it is surprising how conservative has been our approach to the teaching of physics at an elementary level and how persistently so many have clung to the traditional exercising of students in the trivia of phenomenological physics. Only very recently has there been a concerted effort to bring the introductory courses up to date; the PSSC course has been widely discussed and attempts (with a large measure of success) to do for the high school what still generally needs to be done for the university. It is surely unnecessary to belabor again the many reasons for the PSSC course being overwhelmingly superior to its high-school forerunners, and the same general comments can be applied to many university courses. By now it really should not be necessary to plead the same case with every new approach to university physics teaching; we shall consider this as done, and discuss the book under review on this basis.

It is clear from the many excellent sections that the authors have a very clear idea of what they have wanted to do and have themselves a much clearer and deeper understanding of their material than is sometimes apparent in such books. The progression from one chapter to the next follows a logical chain from basic dynamical concepts, through oscillators, gravitation, inertial forces, rigid body motion, to temperature, heat, basic atomic and molecular ideas, to kinetic theory, elementary thermodynamics, motion of fluids, and the last three chapters on waves. There is a great amount of fine material and a truly enormous selection of problems at the end of each chapter.

On re-reading the notes made during a detailed reading of the book, some strong general impressions emerge. Foremost of these is satisfaction at some elegant presentations which demonstrate a strong physical feeling. Such, for example, is the section 8–8 in which forced and damped oscillations are described. Another example is the treatment of Rutherford scattering (pp. 283–297). Tempering this good impression, however, there is a persistent trickle of petty annoyances. In the first few chapters, there is much recourse to specialized apparatus—cars for 1-dimensional cases and pucks for 2-dimensional—where this apparatus is by no means universal and where a demonstration in front of the class will illustrate the particular points desired. In fact, as on p. 48, rather crude experimental data so derived are used to lend credence to some basic principles being discussed. But does this really help? Would it not be better to discuss idealized experiments first, and leave the very rough experimental checks to classroom demonstrations?

On several occasions, one gets the impression that the authors have started out with too general a coverage and have had to curtail abruptly their treatment when the generalized case proves too complicated. There are also many places where perfectly correct statements are made but with little or no justification (e.g., p. 191, the introduction of the $1/(1-\beta^2)^{\frac{1}{2}}$ factor or, p. 460, the introduction of Planck's h). The chapters dealing with waves (Ch. 21, 22, 23) are perhaps deceptively