87[G, H, X].—F. A. FICKEN, *Linear Transformations and Matrices*, Prentice-Hall, Inc., Englewood Cliffs, N. J., 1967, xiii + 398 pp., 24 cm. Price $10.50.

In spite of many entertaining historical digressions, this is a tight book. Much ground is covered. It is assumed that the reader knows only elementary Cartesian geometry and trigonometry. So the early chapters start out with set theory, mathematical induction, propositions, the real numbers, order, vectors in three dimensions, groups, isomorphism, and related notions. Chapter 5, "Linear spaces," deals with linear dependence and bases. Chapter 6 is on "Linear transformations," and duality enters in Chapter 7. Determinants arise in Chapter 11. The Jordan canonical form comes in the next chapter, and Chapter 14, the last, deals with "Similar operators on a unitary space." Interspersed are 760 exercises (by the author's count), and at the end are seven pages of bibliography, carefully classified, 31 pages of "Selected answers and hints," three pages for an index of symbols, and an index of eight pages.

The book has developed through in-training courses given at the Gaseous Diffusion Plant in Oak Ridge, and courses given at the University of Tennessee and at New York University. Generally, these have been three-quarter courses. Throughout, the emphasis is on geometry and applications, hence, so far as possible, on coordinate-free representation.

The phraseology is meticulously precise and highly literate (by contrast with much current literature). To teach to the audience intended would be pleasant but possibly demanding. For readers of this journal it should be remarked that little attention is given to computational techniques, but this is a subject in itself.

A. S. H.

88[G, H, X].—ANDRÉ KORGANOFF & MONICA PAVEL-PARVU, *Éléments de Théorie des Matrices Carrées et Rectangles en Analyse Numérique*, Dunod, Paris, 1967, xx + 441 pp., 25 cm. Price 98 F.

This is the second book of a series, and it must be said at the outset that this book is at a level quite different from that of its predecessor. For a reading of Volume 1, little was required beyond reasonable mathematical maturity. The present volume is divided into two parts, entitled "Vectorial algebras and normal algebras of matrices," and "Inverses of rectangular matrices," and it begins with Chapter 1.1, whose title may be translated as "Recollections of functional analysis" (the first word is "rappels," and there is no strict English equivalent). The point is simply that many theorems are stated without proof. The other two chapters, covering a total of nearly a hundred pages, deal with norms. And still the proofs are minimal or omitted altogether. We are promised a third volume that will, presumably, fill the gaps.

The main theme occurs in the second part, and is easily recognized as the "pseudo-inverse" (as the authors call it), the "generalized inverse" (as it is often designated), or the "general reciprocal" (in the phraseology of E. H. Moore, the inventor). The fact that the treatment extends to more than 250 pages indicates the amplitude of the development.

There are three separate bibliographies, one "general," and one for each "part." There is no index. There are numerical examples. It is a book only for the mathematically mature professional, who will find therein a vast amount of information.

A. S. H.

89[H, K, M, P, Q, S, T, V, W, X, Z].—BEN NOBLE, *Applications of Undergraduate Mathematics in Engineering*, The Mathematical Association of America, The Macmillan Co., New York, 1967, xvii + 364 pp., 24 cm., Price $9.00.

This delightful book goes a long way towards making it clear that "Part of the art of engineering mathematics is to balance the complexity of the engineering problem and the sophistication of the mathematics used against the degree of accuracy and certainty required in the final conclusion." The author, who is an eminent artist in this medium, began with some examples culled by the Advisory Editorial Committee consisting of Rutherford Aris, R. Creighton Buck, Preston R. Clement, E. T. Kornhauser, and H. O. Pollak. He states in his Preface:

". . . This book is based on examples of applications of undergraduate mathematics in engineering, submitted for the most part by members of engineering and mathematics departments of universities, with some contributions from industrial companies. These were requested by the Commission on Engineering Education and the Committee on the Undergraduate Program in Mathematics.

"One of the principal aims has been to write a book for a reader who has no specialized knowledge of any branch of mathematics, the physical sciences, or engineering."

Actually, the author makes reference to college algebra, trigonometry, analytic geometry, calculus, elementary ordinary differential equations, elementary linear algebra, elements of probability theory (Poisson, binomial, and normal distributions), elementary knowledge of computers and flow charts. On the other hand, he "tried to describe physical and engineering situations from first principles, by which we mean basic physical laws such as Newton's laws of motion, the decomposition of forces, Hooke's law in elasticity (extension proportional to force), the basic laws governing electrical networks, and some simple ideas in connection with chemical reactions."

". . . There has been no attempt to provide systematic coverage of topics in either engineering or mathematics. I have merely taken the random sample of examples chosen by the selection committee and added a number of related examples suggested by other sources. It is purely accidental, for example, that the flow charts for computer programs given in the text involve only examples in probability, and that so much attention has been devoted to probability as opposed to statistics."

The author tries in most cases to give:

(1) "Explanation of the engineering motivation of the problem."

(2) "Abstraction, idealization and formulation" (of the mathematical problem).

(3) "Solution of the mathematical problem."

(4) "The relevance of the results to the original problem."

After an introductory chapter, the book is divided into five parts, each having several chapters:

Part I. Illustrative Applications of Elementary Mathematics