and by no means trivial examples, including that of the zero energy scattering of electrons by hydrogen atoms.

The book concludes with a treatment of the basic work by Lippmann and Schwinger on formal time-dependent scattering theory, but, for only the second instance in the volume, the treatment is probably too terse to be really useful. In general, the treatment of material throughout the text is sufficiently thorough to enable second year graduate students of physics not only to follow but to profit considerably; with the possible exception of some of the formal material on quantum mechanics and the treatment of the Dirac equation, the same should be true for students of mathematics.

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47[S, X].—HARRY H. DENMAN, WILFRIED HELLER & WILLIAM J. PANGONIS, *Angular Scattering Functions for Spheres*, Wayne State University Press, Detroit, Michigan, 1966, xix + 294 pp., 24 cm. Price \$7.50.

Let

$$i_\perp = \left| \sum_{n=1}^{\infty} \{A_n \pi_n (\cos \alpha) + B_n \tau_n (\cos \alpha)\} \right|^2,$$

$$i_\parallel = \left| \sum_{n=1}^{\infty} \{A_n \tau_n (\cos \alpha) + B_n \pi_n (\cos \alpha)\} \right|^2.$$

$\pi_n(x) = dP_n(x)/dx$, $\tau_n(x) = x\pi_n(x) - (1 - x^2)d\pi_n(x)/dx$, where $P_n(x)$ is the Legendre polynomial of degree n. Also the coefficients A_n and B_n depend on the Riccati-Bessel functions.

$S_n(x) = (\pi x/2)^{1/2} J_{n+1/2}(x)$, $C_n(x) = (-1)^n (\pi x/2)^{1/2} J_{-n-1/2}(x)$. A_n and B_n are functions of $S_n(\alpha)$ and $S_n(\beta)$ where $\beta = m\alpha$. This volume tabulates $i_\perp/\alpha^3$ and $i_\parallel/\alpha^3$ to 5S for $\alpha = 0.2(0.2)25$, $\alpha = 0°(5°)180°$, $m = 1.05(0.05)1.30, 1.333$.

The method of computation and the checks used are explained in detail, and the authors conclude that "the fifth figure in these tables is *correct* in most cases, and is *significant* almost always." (The italics are theirs.) The present tables are the most complete on the subject. For a description of the physical aspects of the problem to which the tables relate and previous tables, see *MTAC*, v. 3, 1949, p. 483–484 and *MTAC*, v. 6, 1952, p. 95–97.

Y. L. L.

48[W, X].—V. S. NEMCHINOV, Editor, *The Use of Mathematics in Economics*, The M. I. T. Press, Cambridge, Massachusetts, 1965, xxi + 377 pp., 26 cm. Price \$12.50.

The present work constitutes a sample of recent East European (principally Soviet) work on mathematical economics.

The first article, by V. S. Nemchinov, gives an introductory discussion of industrial input-output matrices and their applications, with emphasis on planning of uniform growth. A gross national balance sheet for the Soviet economy (years

1923–1924!) is also given. The second article, by V. V. Novozhilov, is considerably longer, and essentially constitutes a pedagogical monograph, written to appeal to the Russian economic manager (presumably as nervous about these new-fangled inventions of the ivory-tower types as are U. S. managers) of elementary linear programming. Profitability (in percent per year) is emphasized as an investment criterion, this criterion is shown to be equivalent to various criteria of desirability: maximum growth rate, maximum return on total investment, etc. A certain amount of effort is devoted to establishing the compatibility (in a suitably 'higher' sense) of the new rational methods with the obligatory Marxist ideological base.

Two additional articles, by L. V. Kantorovich, develop the linear programming method in more detail, bringing out the mathematical bases of the method in terms of the dual problem of linear programming—called by Kantorovich the method of resolving multipliers. A variety of elegant small applications to machine shop scheduling, plywood cutting, etc. are discussed in detail, and some indication of numerical methods given. The first of these two papers (published 1939) is in fact one of the pioneering works on linear programming.

A good bibliography by A. A. Korbut surveys the development of linear programming, both in the USSR and abroad.

A short article by Oscar Lange discusses models of economic growth in the context of input-output analysis; these models are regarded as multi-sector developments of primitive two- and three-sector ones which may be construed out of Marx.

An article by A. L. Lure derives useful practical algorithms for the solution of rail-transport optimization problems by elementary linear programming and graph theoretical means.

Apparent in the whole volume is the convergence of Soviet planning economics with American single-firm efficiency economics. As Novozhilov puts it, quoting a Russian proverb: "Every vegetable has its season."

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49[X].—F. CEȘCHINO & J. KUNTZMANN, *Numerical Solution of Initial Value Problems*, translated by D. Boyanovitch, Prentice-Hall, Inc., Englewood Cliffs, N. J., 1966, xvi + 318 pp., 24 cm. Price $10.50.

In Chapter 1 the authors introduce notational conventions, terminology (canonical forms, resolved forms, equilibrated resolved forms, etc.), brief statements of existence theorems (assuming functions are differentiable), and brief comments on numerical procedures.

Chapters 2–5 cover approximately 100 pages and are devoted mainly to deriving various single-step formulas, from Euler's method, through Runge-Kutta methods, to variants on these methods, such as one due to Blaess, and the implicit Runge-Kutta methods. Some Runge-Kutta formulas of order 5 and 6 are given, as well as a proof that formulas of order 5 cannot be obtained with only five function evaluations.

In Chapter 6 (Adams Method and Analogues) some special multistep formulas