48[3, 9, 10, 13].—MICHEL SIMONNARD, *Linear Programming*, translated by William S. Jewell, Prentice-Hall, Inc., Englewood Cliffs, N. J., 1966, xxiv + 430 pp., 24 cm. Price $9.00.

This is an exceptionally well-written and well-translated book on linear programming and related subjects which will serve as an excellent text for a one- or two-semester course or for independent study. The book contains the usual linear programming material (primal-simplex method, dual-simplex method, duality, primal-dual method, parametric programming), two chapters on linear programming in integers and mixed integer programming (there is only a brief description by the translator of branch-and-bound methods), one chapter on bounded variables and the Dantzig-Wolfe decomposition principle, and five chapters on transportation problems. Two appendices present a self-contained review of linear algebra and convex polyhedra, and a third appendix gives some basic definitions of graph theory. There is also a four-page English-French glossary and a 169-item bibliography. (The addition of numerical exercises at the end of each chapter of this book would probably make it an unbeatable textbook on the subject.)

O. L. MANGASARIAN

Mathematics Research Center
University of Wisconsin
Madison, Wisconsin

49[4, 5, 13.15, 13.35].—JACK K. HALE & JOSEPH P. LASALLE, Editors, *Differential Equations and Dynamical Systems*, Academic Press, New York, 1967, xvii + 544 pp., 24 cm. Price $18.00.

We copy the dedication of this book:

This volume, as was the Symposium itself, is dedicated to Solomon Lefschetz for the many contributions he has made over the past 20 years to the development of this subject. He has influenced most of us either directly or indirectly, and to many of us he has been a mentor and a father mathematician through his inspiration, encouragement, and guidance. In life as well as in mathematics he has been a true friend and a true companion.

An excerpt from the preface follows:

This volume is the proceedings of the third of a series of international symposia on differential equations and related topics. Speakers were invited to discuss advances in the theory of ordinary differential equations including both qualitative and geometric theory, the theory of stability and control, hereditary phenomena (functional differential equations), and special topics in the theory of partial differential equations. In addition, papers containing significant new results were accepted for presentation. Invited speakers whose reports are included in this volume are: H. A. Antosiewicz, R. F. Arenstorf, L. Cesari, K. L. Cooke, A. Friedman, U. Grenander, A. Halanay, J. K. Hale, P. Hartman, J. Kurzweil, J. P. LaSalle, Solomon Lefschetz, N. Levinson, J. Moser, N. Onuchic, M. Peixoto, and S. Smale.

The International Symposium on Differential Equations and Dynamical Systems was held at the University of Puerto Rico, Mayaguez, Puerto Rico, from December 27 to 30, 1965, and was sponsored by the United States Air Force Office of Scientific Research, the University of Puerto Rico, and Brown University.

The complete list of papers appears below:

Geometric Differential Equations: Recent Past and Proximate Future—Solomon Lefschetz, On the Theory of Quasiperiodic Solutions of Differential Equations—J. Moser, Existence of Quasiperiodic Solutions to the Three-Body Problem—Burton B. Lieberman, Applications of the Cunningham Integral to the Oblate Earth Problem—W. T. Kyner, A Perturbation Theorem for Invariant Riemannian Manifolds—Robert J. Sacker, New Periodic Solutions of the Plane Three-Body Problem—Richard F. Arenstorf, Periodic Solutions of a Nonlinear Wave Equation—P. H. Rabinowitz, A Minimax Proof of the Existence of an Optimal Control Making a Finite Number of Jumps in the Linear Bang-Bang Theory—N. Levinson, The Existence of Optimal Controls for a Performance Index with a Positive Integrand—R. Datko and M. Anvari, Adaptive Stochastic Control—Ulf Grenander, Control of Linear Time Delay Systems with Essentially Linear Cost Functionals—D. H. Chyung and E. B. Lee, Existence Theorems for Multidimensional Problems of Optimal Control—Lamberto Cesari, Algebraic Aspects of the Theory of Dynamical Systems—R. E. Kalman, An Extension Theorem for Asymptotic Stability and Its Application to a Control Problem—Nam P. Bhatia and George P. Szegö, Discontinuous Vector Fields and Feedback Control—H. Hermes, Functional-Differential Equations: Some Models and Perturbation Problems—Kenneth L. Cooke, A Note on Periodic Solutions of Nonlinear Differential Equations with Time Lags—Carlos Perello, Hereditary Dependence in Dynamics—G. Stephen Jones, Invariant Manifolds for Systems with Time Lag—A. Halanay, On the Bifurcation of Periodic Solutions in Non-linear Difference-Differential Equations of Neutral Type—R. K. Brayton, The Asymptotic Distribution of Characteristic Exponents for Periodic Differential-Difference Equations—J. C. Lillo, On the Asymptotic Behavior of the Solutions of Functional-Differential Equations—Nelson Onuchic, On "In the Large" Application of the Contraction Principle—S. C. Chu and J. B. Diaz, On the Existence of Solutions to Linear Differential-Difference Equations—K. R. Meyer, Geometric Theory of Functional-Differential Equations—Jack K. Hale, Asymptotic Behavior of Solutions near Integral Manifolds—Taro Yoshizawa and Junji Kato, An Invariance Principle in the Theory of Stability—Joseph P. LaSalle, A Stability Criterion for a Panel Flutter Problem via the Second Method of Liapunov—P. C. Parks, Variational Methods for Stability of Periodic Equations—R. W. Brockett, Stability Criteria for nth Order, Homogeneous Linear Differential Equations—E. F. Infante, Domains of Attraction of Some Quasiperiodic Solutions—P. R. Sethna, Inverse Liapunov Problems—Ruey-Wen Liu and R. Jeffrey Leake, Finite Time Stability under Perturbing Forces and on Product Spaces—Leonard Weiss and E. F. Infante, Stability of Periodic Linear Lagrangian Systems—Michel Cotsaftis, Asymptotically Self-Invariant Sets and Conditional Stability—V. Lakshmikantham and S. Leela, On Global Weak Attractors in Dynamical Systems—Nam P. Bhatia, Alan C. Lazer, and George P. Szegö, On General Dynamical Systems and Finite Stability—T. G. Windeknecht and M. D. Mesarovic, On Quasilinear Elliptic Functional-Differential Equations—Philip Hartman, Asymptotic Behavior of Solutions of Parabolic Differential Equations and of Integral Equations—Avner Friedman, Nonlinear Boundary Value Problems—H. A. Antosiewicz, Invariant Manifolds for Flows—Jaroslav Kurzweil, Qualitative Theory of Differential Equations and Structural Stability—M. M. Peixoto, Structural Stability on M^2—Charles C. Pugh, Dynamical Systems on n-Dimensional Manifolds—S. Smale. Dynamical

Systems on Group Manifolds—Lawrence Markus, A Conjecture on Local Trajectory Equivalence—Courtney Coleman, Forced Oscillations in Second Order Systems with Bounded Nonlinearities—O. Benediktsson and B. A. Fleishman, Uniqueness Theorems for Initial Value Problems—Robert D. Moyer, Existence and Uniqueness of Solutions to the Second Order Boundary Value Problem—Paul B. Bailey, Lawrence F. Shampine, and Paul E. Waltman, An Application of Popov's Method in Network Theory—Vaclav Dolezal, Topologies for Linear Spaces of Nonlinear Differential Equations—Hubert Halkin, On Nonelementary Hyperbolic Fixed Points of Diffeomorphisms—Kuo-Tsai Chen, Nonautonomous Differential Equations as Dynamical Systems—George R. Sell.

E. I.

50[5].—Françoise Michaud, "Sur le calcul numérique des valeurs propres de l'équation de Hill," *Comptes Rendues de l'Académie des Sciences de Paris*, Series A, v. 264, 1967, pp. 867–870.

This note presents concise details of an application of the method of "intermediate problems," developed by Weinstein [1], Aronszajn [2], and Bazley [3], to the calculation of the eigenvalues, θ_0, of Hill's equation

$$u'' + \left(\theta_0 + 2 \sum_{j=1}^{p} \theta_j \cos 2jz\right)u = 0$$

for which there exist even periodic solutions of period π corresponding to given values of θ_j ($j \geqq 1$).

The first N eigenvalues are tabulated, correct to from 11S to 3S (as N and p increase), for the four cases: $\theta_1 = 1, \theta_2 = 0.2, p = 2, N = 6; \theta_1 = 3, \theta_2 = -0.4, p = 2, N = 6; \theta_1 = 1, \theta_2 = 0.2, \theta_3 = 1, p = 3, N = 11$; and $\theta_1 = 1, \theta_2 = 0.2, \theta_3 = 1, \theta_4 = 0.5, \theta_5 = 2.1, \theta_6 = 0.2, \theta_7 = 1, p = 7, N = 15$. In the first two cases good agreement is shown to exist between the decimal approximations found here for the first two eigenvalues and the corresponding 4D values found by Klotter and Kotowski [4] by the method of continued fractions.

J. W. W.

1. A. Weinstein, *Etude des spectres des équations aux derivées partielles*, Mémorial des Sciences Mathématiques, No. 88, Paris, 1937.

2. N. Aronszajn, "Approximation methods for eigenvalues of completely continuous symmetric operators," *Proc. Symposium on Spectral Theory and Differential Problems*, Stillwater, Oklahoma, 1951.

3. N. W. Bazley, "Lower bounds for eigenvalues," *J. Math. Mech.*, v. 10, 1961, pp. 289–307.

4. K. Klotter & G. Kotowski, "Über die Stabilität der Lösungen Hillscher Differentialgleichungen mit drei unabhängigen Parametern," *Z. Angew. Math. Mech.*, v. 23, 1943, pp. 149–155.

51[5, 6].—R. D. Richtmyer & K. W. Morton, *Difference Methods for Initial-Value Problems*, Interscience Publishers, New York, 1967, xiv + 405 pp., 24 cm. Price $14.95.

The brilliantly conceived and executed, the most often quoted monograph on difference methods for solving partial differential equations, has been improved upon in this second, completely revised, edition! Here the blending of theoretical analysis and intuitive formulation of methods is ideal and au courant with the current state of the art and science of computing.

"The principal theoretical advances are (1) the rounding-out or completion of