

not be considered to represent any mode other than the fundamental vibration mode. Using

$$\phi = A_1 \left( \frac{x^2}{a^2} + \frac{y^2}{b^2} - 1 \right)^2 + A_2 \left( \frac{x^2}{a^2} + \frac{y^2}{b^2} - 1 \right)^3 \quad (1)$$

the results quoted for  $\lambda_1^2$  and  $\lambda_2^2$  were

$$\lambda_1^2 = 1.6341(24/a^4)[1 + (2a^2/3b^2) + (a^4/b^4)] \quad (2)$$

and

$$\lambda_2^2 = 5.3825(24/a^4)[1 + (2a^2/3b^2) + (a^4/b^4)] \quad (3)$$

In Ref. 2, the present writer assumed the following modal form in a panel flutter analysis:

$$\phi = A_1 \left( \frac{x^2}{a^2} + \frac{y^2}{b^2} - 1 \right)^2 + A_2 x \left( \frac{x^2}{a^2} + \frac{y^2}{b^2} - 1 \right)^2 \quad (4)$$

and the first two eigenfrequencies found for these two uncoupled modes are expressed by

$$\lambda_1^2 = (40/a^4)[1 + (2a^2/3b^2) + (a^4/b^4)] \quad (5)$$

and

$$\lambda_2^2 = (300/a^4)[1 + (2a^2/5b^2) + (a^4/5b^4)] \quad (6)$$

It can be deduced by comparison of Eqs. (2) and (5) that the inclusion of the additional  $A_2$  term in Eq. (1) has had very

little influence on the value of the lowest eigenfrequency determined.

To assess the accuracy of the forementioned approximate results, comparison can be made for the particular case of a clamped-edge circular plate with the exact results presented in Ref. 3 for the first two eigenfrequencies, i.e.,

$$\lambda_1^2 = 105/a^4 \quad \lambda_2^2 = 464/a^4 \quad (7)$$

The corresponding results from Eqs. (5) and (6) are

$$\lambda_1^2 = 106.67/a^4 \quad \lambda_2^2 = 480/a^4 \quad (8)$$

whereas from Eqs. (2) and (3), one obtains

$$\lambda_1^2 = 104.58/a^4 \quad \lambda_2^2 = 344/a^4 \quad (9)$$

Thus, although the two-term analysis of Ref. 1 gives a better approximate result for the lowest eigenfrequency than a one-term analysis, the expression quoted in Ref. 1 for the second eigenfrequency has no physical significance.

## References

- <sup>1</sup> McNitt, R. P., "Free vibration of a damped elliptical plate," *J. Aerospace Sci.* 29 (1962).
- <sup>2</sup> Johns, D. J., "Some panel flutter studies using piston theory," *J. Aerospace Sci.* 25 (1958).
- <sup>3</sup> Rattaya, J. V., "Flutter analysis of circular panels" *J. Aerospace Sci.* 29, 578-582 (1962).

# Book Notes

**Space Research and Technology**, edited by G. V. E. Thompson (Gordon and Breach Science Publishers, New York, 1962), 216 pp. \$5.95.

**Contents:** 31 papers contributed by different authors and divided into 5 major sections. Section 1) Space Medicine Symposium; Section 2) Rocket and Satellite Instrumentation Symposium; Section 3) High Altitude Chambers and Pressure Suits and Their Part in Manned Flight to the Moon; Section 4) Space Navigation Symposium; Section 5) Liquid Hydrogen Symposium.

This volume contains the Proceedings of four Symposia sponsored by the British Interplanetary Society. Engineers and scientists from five different countries, including the United States, have papers included in the volume.

**Developments in Theoretical and Applied Mechanics**, edited by the Technical Publications Department, Technical Information Division, Oak Ridge National Laboratory (Plenum Press, New York, 1963), Vol. 1, 519 pp. \$16.00.

**Contents:** 32 papers contributed by different authors and divided into 4 major parts. Part 1) Solid Mechanics; Part 2) Fluid Mechanics; Part 3) Dynamics and

Vibrations; Part 4) Experimental and Applied Mechanics.

This volume contains the Proceedings of the First Southeastern Conference on Theoretical and Applied Mechanics, held at Gatlinburg, Tenn., May 3-4, 1962, and sponsored by the Oak Ridge National Laboratory. Engineers and physicists will find in this book material both valuable in the solution of practical problems and useful as suggestions for theoretical treatments of the many aspects of mechanics.

**Electric Circuit Analogies for Elastic Structures**, Richard H. MacNeal, *Computer Engineering Associates, Pasadena, Calif.* (John Wiley & Sons Inc., New York, 1962), Vol. 2, 262 pp. \$11.50.

**Chapters:** 1) Introduction; 2) Electrical Circuit Analysis; 3) Basic Techniques Used in Deriving Analogies; 4) Analogies for Structures That Consist of One-Dimensional Elements; 5) Analogies for Two-Dimensional Structural Elements; 6) Practical Considerations in the Construction of Analogies for Static Structural Analysis; 7) Examples of Aircraft Static Structural Analysis; 8) Dynamic Analysis; 9) Applications to Other Types of Structural Analysis; 10) General Theorems and Special Synthesis Procedures.

This book indicates and exploits the similarities between concepts in electric circuit theory and concepts in elastic structure theory. Specialized knowledge of electric circuit theory is not a prerequisite, since the required circuit theory principles are developed in the book. This volume may be used as an introductory text for those wishing knowledge of the

analogies between mechanics and electricity, as a compilation of methods and techniques for users of direct analog computing, and as an exposition of the scope of direct analog computer methods in the solution of structural problems.

**Navigation and Guidance in Space**, Edward V. B. Stearns, *Manager, Advanced Program Development, Space Systems Division, Lockheed Missiles and Space Company* (Prentice-Hall Inc., Englewood Cliffs, N. J., 1963), 341 pp. \$12.00.

**Chapters:** 1) Introduction to Space Flight; 2) Orbit Characteristics; 3) Instrumentation; 4) Guidance of the Ballistic Missile; 5) Navigation for Satellites; 6) Interplanetary Navigation; 7) Navigation to the Moon; 8) Navigation in Interstellar Flight. **Appendices:** 1) Glossary of Terms; 2) Glossary of Symbols; 3) Data on the Solar System; 4) Relation between Coordinates and Parameters; 5) Orbit Equations and Associated Relations; 6) Conversion Tables.

This book treats the problem of space navigation in each of the several environments. Emphasis is placed on navigation rather than on guidance systems design or trajectory calculations. The bulk of the text material deals with spacecraft guidance as though the function actually were performed by a crew member.

**Developments in Mechanics**, edited by J. E. Lay, *Professor of Mechanical Engineering, Michigan State University*, and L. E. Malvern, *Professor of Applied Mechanics, Michigan State University* (Plenum Press,

The books listed here are those recently received by the AIAA from various publishers who wish to announce their current offerings in the field of astronautics. The order of listings does not necessarily indicate the editors' opinion of their relative importance or competence.

New York, 1961), Vol. 1, 622 pp. \$19.50 domestic, \$21.00 foreign.

*Contents:* 49 papers contributed by different authors and divided into 2 major parts. Part 1) Solid Mechanics; Part 2) Fluid Mechanics.

This volume contains the Proceedings of the Seventh Midwestern Mechanics Conference, held at Michigan State University, September 6-8, 1961. It should be an important reference source for workers in the fields of fluid mechanics and solid mechanics. Both experimental and theoretical studies are reported.

**Electron Density Profiles in the Ionosphere and Exosphere**, edited by B. Maehlum, *Norwegian Defence Research Establishment* (Macmillan Company, New York, 1962), 418 pp. \$15.00.

*Contents:* 43 papers contributed by different authors and divided into 9 major sections. Section 1) Electron Densities in the Normal *D* Layer; Section 2) Electron Density Observations during Polar Blackouts; Section 3) Electron Densities in the *E* Region; Section 4) Theories on Electron Production and Recombination in the *D* and *E* Layers; Section 5) Electron Density Profiles in the *F* Region; Section 6) Electron Density Distribution of the Upper *F* Region; Section 7) Theories of the *F* Region; Section 8) Incoherent Scattering from the Outer Ionosphere; Section 9) Theory and Observations on the Exosphere.

This volume contains the Proceedings of a NATO Advanced Institute arranged by the Norwegian Defence Research Establishment, Skeikampen, Norway, April 1961, and sponsored by the Science Committee of NATO. This book gives the complete papers presented at the Study Institute and summaries of the discussions.

**Methods of Mathematical Physics**, R. Courant and D. Hilbert (Interscience Publishers, New York, 1962), Vol. 2, 830 pp. \$17.50.

*Chapters:* 1) Introductory Remarks; 2) General Theory of Partial Differential Equations of First Order; 3) Differential Equations of Higher Order; 4) Potential Theory and Elliptic Differential Equations; 5) Hyperbolic Differential Equations in Two Independent Variables; 6) Hyperbolic Differential Equations in More Than Two Independent Variables.

This second volume of a three-volume set is entitled *Partial Differential Equations*. The aim of the book is to make an important branch of mathematical analysis more accessible by emphasizing concepts and methods rather than presenting a collection of theorems and facts and by leading from an elementary level to key points on the frontiers of our knowledge.

**Nonlinear Transformations of Random Processes**, Ralph Deutsch, *Space Systems Division, Hughes Aircraft Company, Culver City, Calif.* (Prentice-Hall Inc., Englewood Cliffs, N. J., 1962), 157 pp. \$7.95.

*Chapters:* 1) Envelopes and Pre-Envelopes; 2) Characteristic Function Method; 3) Correlation Function Method;

4) Multiplication and Power Law Devices; 5) Modulation and Detection; 6) Series Approximations; 7) Techniques Using Differential and Integral Equations; 8) Sampling and Quantizing. *Appendix:* Notes on Hypergeometric Functions.

Prerequisites for understanding this book include statistics, probability, complex variables, and Fourier and Laplace transforms. It may be used as a graduate-level text in departments of mathematics, physics, and electrical engineering. It also may be of use to researchers in pertinent fields, engineers concerned with control and communications theory, and physicists and chemists dealing with certain problems in atomic theory.

**Hall-Effect Instrumentation**, Barron Kemp (Howard W. Sams & Co. Inc., Indianapolis, Ind., 1963), 128 pp. \$4.95.

*Chapters:* 1) Mr. Hall's Effect; 2) Multiplier Applications; 3) Wattmeters; 4) Modulators; 5) Constant Control Current Applications; 6) Displacement Applications; 7) Magnetoresistive Devices; 8) Measuring Magnetic Fields.

This practical book contains the essence of the discoveries made during the past 10 years. The basic principles of each Hall-effect device are described in order to facilitate a better understanding of this type of instrumentation.

**Problems of Extra-Galactic Research**, edited by G. C. McVittie, *Professor of Astronomy and Head of the Department of Astronomy, University of Illinois* (Macmillan Company, New York, 1962), 450 pp.

*Contents:* 39 papers contributed by different authors and divided into 3 major parts. Part 1) Normal Galaxies as Stellar Systems; Part 2) Multiple Systems, Clusters, and Radio Galaxies; Part 3) Galaxies as Members of the Universe.

This volume contains the Proceedings of the International Astronomical Union Symposium No. 15, held at the Santa Barbara campus of the University of California, August 10-12, 1961. The observations discussed are those which can be made with optical telescopes and also with radio telescopes. The papers are arranged in the order in which they were delivered, and each is followed by the discussion to which it gave rise.

**Real Gases**, Ali Bulent Cambel, *Gas Dynamics Laboratory, Department of Mechanical Engineering, Northwestern University*, Donald P. Duclos, *Plasma Propulsion Laboratory, Republic Aviation Corporation*, and Thomas P. Anderson, *Gas Dynamics Laboratory, Department of Mechanical Engineering, Northwestern University* (Academic Press, New York, 1963), 166 pp. \$6.50.

*Chapters:* 1) Introduction to Real Gas Effects; 2) Introduction to Aerothermochemical Analysis; 3) Thermal and Caloric Equations of State; 4) The Debye-Hückel Theory for Ionized Gases; 5) High Pressure Real Gas Effects; 6) Dissociation and Recombination; 7) Ionization and Neutralization.

This treatment of real gas phenomena at high temperatures places particular emphasis on the regimes encountered in aerospace applications. The authors' objective was to review the art and the science underlying the behavior of real gas. This monograph should serve as a bridge between equilibrium and nonequilibrium thermodynamics on the one side and high speed gasdynamics on the other side.

**Liquid Propellant Engines**, N. I. Melek-Pashayev, translated by W. E. Jones, translation edited by B. P. Mullins (Macmillan Company, New York, 1963), 175 pp. \$3.50.

*Chapters:* 1) General Layout, Basic Parameters, and Fields of Application of Liquid-Propellant Engines; 2) Fuels for Liquid-Propellant Engines; 3) Combustion Chamber of Liquid-Propellant Engines; 4) Exhaust Nozzles of Liquid-Propellant Engines and the Processes Taking Place in Them; 5) Characteristics of Liquid-Propellant Engines; 6) Cooling of Liquid-Propellant Engines; 7) Fuel System for Liquid-Propellant Engines; Starting the Engine and Its Control.

Written for students and technologists, this volume serves as an elementary introduction to the basic principles of liquid-propellant engines. It does not require an advanced knowledge of mathematics and chemistry in order to be understood fully. Data relating to a selection of specific American, British, and German rocket engines are presented.

**Proceedings of the NASA-University Conference on the Science and Technology of Space Exploration** (U. S. Government Printing Office, Washington, D. C., 1962), 2 Vols. Vol. 1, 429 pp., \$2.50. Vol. 2, 532 pp., \$3.00.

*Contents:* 75 papers contributed by different authors and divided into 22 major sections. Section 1) NASA's Role in Space Exploration; Section 2) Developing Special Skills for Research in the Space Sciences; Section 3) Impact of the Space Program on the Universities; Section 4) The Role of the University in Meeting National Goals in Space Exploration; Section 5) Radar Astronomy; Section 6) Sounding Rockets; Section 7) Geophysics and Astronomy; Section 8) Lunar and Planetary Sciences; Section 9) Celestial Mechanics and Space Flight Analysis; Section 10) Data Acquisition and Processing; Section 11) Control, Guidance, and Navigation; Section 12) Bioastronautics; Section 13) Chemical Rocket Propulsion; Section 14) Nuclear Propulsion; Section 15) Power for Spacecraft; Section 16) Electric Propulsion; Section 17) Aerodynamics; Section 18) Gas Dynamics; Section 19) Plasma Physics and Magnetohydrodynamics; Section 20) Laboratory Techniques; Section 21) Materials; Section 22) Structures.

These two volumes contain the Proceedings of a Conference held in Chicago, Ill., November 1-3, 1962, sponsored by NASA. The purpose of the Conference, at which some 300 major universities were represented, was to highlight the scope, significance, and national urgency of the space program.