

free end but becomes more abrupt and localized for the load close to the clamped end. It would be expected, therefore, that for equivalent accuracies, N in Eqs. (10) would have to have a larger value for a load near the clamped end than would be required if the load were near the free end. It was found, however, that the conditioning of the simultaneous equations that must be solved for a_{mn} , b_{mn} , and c_{mn} was poorer for the loads near the clamped end and that this produced erratic results if N was made too large. That is, rounding off errors in the numerical solution of the simultaneous algebraic equations produced serious discrepancies in the results. Improved numerical methods for solving simultaneous equations would alleviate this difficulty. The values of N for the theoretical results of Figs. 5 and 6 are 15 and 12, respectively.

The last four terms inside the second integral of Eq. (2) are usually neglected in thin-shell theory. Computations with the similar expression for the strain energy produced results that differed only slightly from those using all of the terms in Eq. (2), with the latter case producing generally better agreement with the experimental results. It is expected that for a smoother loading, the difference in the two energy expressions would have a negligible effect. It is also felt that for a smoothly varying load, the agreement between theory and experiment, with $N = 15$, would be satisfactory for engineering computations and would be expected to produce better agreement than has been obtained for the concentrated load. This is evidenced by the satisfactory agreement of the displacements for the load near the free end where the longitudinal variation is smooth.



PUBLICATIONS

- I. Katz, "Radar Reflectivity of the Ocean Surface for Circular Polarization," *I.E.E.E. Trans. on Antennas and Propagation*, **AP-11**, July 1963, 451-453.
- A. W. Nagy and G. E. Friedman, "A No-Field Powder Maser," *Proc. I.E.E.E.*, **51**, July 1963, 1037.
- R. B. Roberts (Dept. of Terrestrial Magnetism, Carnegie Institution of Washington) and F. T. McClure (APL), "Arms, Arms Control, and Foreign Policy," *J. Arms Control*, **1**, July 1963, 163-183.
- L. Monchick (APL) and K. S. Yun and E. A. Mason (University of Maryland), "Formal Kinetic Theory of Transport Phenomena in Polyatomic Gas Mixtures," *J. Chem. Phys.*, **39**, Aug. 1, 1963, 654-669.
- J. F. Bird, "Science—Success of Negative Thinking," University of Scranton, *Alumni Magazine*, Summer, 1963.
- R. B. Kershner, "Gravity-Gradient Stabilization of Satellites," *Astronautics and Aerospace Engineering*, **1**, Sept. 1963, 18-22.
- Helen S. Hopfield, "The Effect of Tropospheric Refraction on the Doppler Shift of a Satellite Signal," *J. Geophys. Res.*, **68**, Sept. 15, 1963, 5157-5168.

- J. P. Kearns, "Flutter Simulation," *Trans. I.S.A.*, **2**, Oct. 1963, 291-297.

— BOOKS —

- R. W. Burnham (Eastman Kodak Co.), R. M. Hanes (APL), and C. J. Bartleson (Eastman Kodak Co.), *Color: A Guide to Basic Facts and Concepts*, John Wiley and Sons, Inc., New York, 1963.

ADDRESSES

- W. H. Guier, Lecture Series on "Geodetic Problems and Satellite Orbits," summer seminar in space mathematics, *American Mathematical Society*, Cornell University, July 29-Aug. 2, 1963.
- R. E. Fischell and F. F. Mobley, "A System for Passive Gravity-Gradient Stabilization of Earth Satellites," *A.I.A.A. Guidance and Control Conference*, Massachusetts Institute of Technology, Aug. 12, 1963.
- A. J. Zmuda, B. W. Shaw, and C. R. Haave, "VLF Disturbances Caused by Trapped Beta Rays from the Decay of Neutrons Produced in High-Altitude Nuclear Explosions," *Symposium on the Ionospheric Propagation of Very Low Frequency Electromagnetic Waves*, Boulder, Colo., Aug. 12-14, 1963.
- R. B. Kershner, "ANNA," *Confer-*

ence on Artificial Satellites, Virginia Polytechnic Institute, Aug. 15, 1963.

- F. T. Heuring, "A Study of the Harmonic Description of the Geomagnetic Field," *International Union of Geodesy and Geophysics*, Berkeley, Calif., Aug. 19-31, 1963.
- A. J. Zmuda and F. T. Heuring, "The Analytic Description of the Geomagnetic Field at Points in the Upper Atmosphere," *International Union of Geodesy and Geophysics*, Berkeley, Calif., Aug. 19-31, 1963.
- A. J. Zmuda, B. W. Shaw, and C. R. Haave, "VLF Disturbances Caused by High-Altitude Nuclear Bursts," *International Union of Geodesy and Geophysics*, Berkeley, Calif., Aug. 19-31, 1963.
- C. O. Bostrom, "Instrumentation and Data Handling Systems for Satellites," *American Physical Society*, Edmonton, Alberta, Canada, Aug. 29, 1963.
- A. M. Stone, Opening Address, session on "Science: Effect of Research on the Economy; Manpower Problems," *17th National Conference on Administration of Research*, Estes Park, Colo., Sept. 11-13, 1963.
- R. E. Gibson, "The Johns Hopkins University Applied Physics Laboratory and Its Work," *The Wednesday Club*, Baltimore, Sept. 25, 1963.

Editorial Board Changes

Dr. R. E. Gibson, Director of the Applied Physics Laboratory, recently announced a change in the composition of the Editorial Board of the *APL Technical Digest*, as reflected on the inside cover of this issue. Dr. Albert M. Stone, former Chairman, and Dr. Walter G. Berl have retired from the Board. Dr. Samuel N. Foner has been appointed Chairman and Dr. Alvin G. Schulz and Dr. Donald J. Williams have been named to Board membership.

Dr. Stone, Technical Assistant to the Director of the Laboratory, was born in Boston, Massachusetts. He received his A.B. degree in physics



from Harvard University and his Ph.D. degree in physics from the Massachusetts Institute of Technology in 1938. Dr. Stone came to APL in 1949 with a background of work in the fields of education and government. He was a research physicist at the U. S. Naval Torpedo Station, associate professor of physics at Montana State College, a staff member of the Radiation Laboratory, Scientific Liaison Officer at the U. S. Embassy in London, and a Division Chief in the Central Intelligence Agency. Among his many contributions to science, Dr. Stone served on the Editorial Board of the *Radiation Laboratory Series*, published in twenty-eight volumes by

the Massachusetts Institute of Technology.

Dr. Stone is supervisor of the Plasma Physics Research Group and has overall cognizance of the Technical Reports Group, the External Relations Group, and the Presentations Office. He is advisor to the Colloquium Committee, Chairman of the Committee on Classification, Regulations, and Procedures, and Secretary of the Technical Policy Board. He is a Fellow of the American Physical Society, a Fellow Member of the Hudson Institute, and a member of the American Association for the Advancement of Science, the Philosophical Society of Washington, the Washington Academy of Sciences, the National Planning Association, and the Special Committee on Arms Control.

Dr. Stone recommended, early in 1961, that the Applied Physics Laboratory establish a journal of science whose purpose would be to disseminate by clear, factual reporting the scientific and technical work of the Laboratory. He can rightly, therefore, be recorded as the founder of the *Digest*. Under his leadership the *APL Technical Digest* has become a serious outlet for Laboratory publications and has contributed to a better understanding of the work of the Laboratory.

Dr. Berl was also a member of the original *Digest* Editorial Board. Born in Vienna, Austria, he received his B.S. degree in chemical engineering from the Carnegie Institute of Technology, his M.A. degree in chemistry from Harvard University, and, in 1941, his Ph.D. degree in physical chemistry from the Carnegie Institute of Technology. From 1941 to 1945, he was a research fellow and instructor in the Department of Chemical Engineering at Carnegie.

Dr. Berl came to APL in 1945 as a specialist in combustion, propulsion, fuels, and propellants, and also is no

stranger to the problems of editorship. He was editor of the three-volume *Physical Methods in Chemical Analysis* published by Academic Press in 1950 and revised in 1960. He has been an editor or associate editor of the *American Rocket Society Journal*, the *American Institute of Aeronautics and Astronautics Journal*, and the National Research Council's *Fire Research Abstracts and Review*. He was Chairman of the Papers Subcommittee of the IXth International Symposium on Combustion at Cornell University in 1962, and editor of its *Proceedings* published by Academic Press in 1963.



Dr. Berl is a member of the American Chemical Society, the Faraday Society, the Electrochemical Society, the American Institute of Aeronautics and Astronautics, the Washington Academy of Sciences, the Philosophical Society of Washington, the Combustion Institute, and is a Fellow of the New York Academy of Sciences. At APL he is supervisor of the Chemical Research Group of the Research Center and is a member of the APL Propulsion Panel. The breadth of his editorial experience and his wide range of technical and scientific knowledge have been of outstanding value to the *Digest* during his two years on the Editorial Board.

WITH THE AUTHORS

W. Liben, a native of Malden, Massachusetts, is supervisor of the Microelectronics Group, of which the facilities described in his "Microelectronics at the Applied Physics Laboratory" are a part. He received his S.B., M.S., and Sc.D. degrees in physics from the Massachusetts Institute of Technology, the last in 1936. Dr. Liben is a specialist in optics, photography, high-vacuum engineering, thin-film evaporation, and oil well instrumentation. Before coming to APL, he was a laboratory assistant at M.I.T., an instructor of physics at Middlesex College, Massachusetts, and served in various research and administrative capacities in the Corps of Engineers Research and Development Laboratories, Simmonds Aerocessories, Inc., Premier Crystal Laboratory, and Brookhaven National Laboratories.



Dr. Liben first came to APL in 1950, leaving in 1954 for a position as research physicist for the Schlumberger Well Surveying Corporation, and returning to APL in 1958. He served APL in several assignments prior to forming the Microelectronics Group in 1960. He is a member of the American Physical Society, the Optical Society of America, the Institute of Electrical and Electronics Engineers, and the American Vacuum Society.

C. J. Swet, author of "Cornucopia in Space," was born in New York City, New York, and received his S.B. degree in naval architecture and marine engineering from the

Massachusetts Institute of Technology in 1946. From 1943 to 1955,



Mr. Swet was employed as an engineer in the design and manufacture of marine equipment, of steam power plant equipment, and in the field of textile processing. He was a senior design engineer at Convair Astronautics Division from 1956 to 1959 in the Missile Propulsion System Design and Development program. At APL since 1959, Mr. Swet was first associated with the Polaris Division, in the submarine subsystem test program and in the evaluation test and analysis programs. His current assignment is special studies for the Space Development Division. He is a member of the American Institute of Aeronautics and Astronautics.

R. M. Rivello, co-author of "A Method of Analysis for Clamped-Free Cylindrical Shells," is a native of Washington, D. C. He received his M.S. degree in mechanical engi-



neering (aeronautical option) from the University of Maryland in 1948, and continued graduate study at the University of Maryland and Ohio State University. Mr. Rivello was for two years the officer in charge of the Structures Research Section of the Aeronautical Research Laboratory at Wright Air Development Center, Dayton, Ohio. He was an assistant professor of mechanical engineering, and is now associate professor of aeronautical engineering, at the University of Maryland. Mr. Rivello is a consultant at APL in structural analysis research and in stress and loads analysis in the Bumblebee missile programs. He is a member of the Institute of Aerospace Sciences, the American Society of Mechanical Engineers, and the Washington Academy of Sciences.



T. M. Rankin, a native of Six Mile Run, Pennsylvania, is co-author of "A Method of Analysis for Clamped-Free Cylindrical Shells." He received his B.S. degree in aeronautical engineering and, in 1962, his M.S. degree in aeronautical engineering from the University of Maryland. Prior to coming to APL in 1962, Mr. Rankin was employed as an engineer at the Naval Air Test Center, Weapon Systems Test Division, at Patuxent, Maryland. He is at present on the staff of the Inertial Project of the Typhon Weapon System Controls Group. Mr. Rankin is a member of the American Institute of Aeronautics and Astronautics.