

high-field water-cooled solenoids (N. A. Blum); cryostats (M. Kalvius); and high-pressure techniques (R. Ingalls).

The whole collection of papers forms an invaluable addition to the published work on experimental techniques in Mössbauer spectroscopy and is an outstanding tribute to the technical virtuosity and enthusiasm of this group of American scientists. N. N. GREENWOOD

RADIO PROGRESS

Progress in Radio Science Series, 1960-1963

XIVth General Assembly of URSI, Tokyo. Vol. 1: Radio Standards and Measurements. Edited by Robert W. Beatty. Pp. viii+111. 50s. Vol. 2: Radio and Troposphere. Edited by F. du Castel. Pp. vi+292. 90s. Vol. 3: The Ionosphere: Review Papers presented at Commission III on Ionospheric Radio. Edited by Geoffrey M. Brown. Pp. v+196. 70s. Vol. 4: Radio Noise of Terrestrial Origin. Edited by F. Horner. Pp. vi+133. 55s. Vol. 5: Radio Astronomy. Edited by E. Herbays in collaboration with J. W. Warwick, R. Coutrez and R. Gonze. Pp. vii+140. 70s. Vol. 6: Radio Waves and Circuits. Edited by F. L. H. M. Stumpers. Pp. vi+327. 135s. Vol. 7: Radioelectronics. Edited by R. E. Burgess. Pp. 168. 60s. Vol. 8: Space Radio Science. Edited by Ken-Ichi Maeda and S. Silver. Pp. v+235. 75s. (Amsterdam, London and New York: Elsevier Publishing Company, 1965, 1966.)

EVERY third year the General Assembly of the International Scientific Radio Union (URSI) meets to review and study the progress made in radio science since the last meeting. The fourteenth in the series took place in Tokyo during September 1963. The complete proceedings have been published under the title *Proceedings of the Fourteenth General Assembly* (Vol. 13), in eight parts, which can be purchased separately from the URSI General Secretariat. In addition, a selection of the review papers invited by the particular chairmen of the various sessions of the assembly and of the proceedings of the following discussions is published as *Progress Reports in Radio Science*. The eight volumes of *Progress in Radio Science, 1960-1963*, contain a selection from the Tokyo meeting. The first seven volumes deal, respectively, with the activities of the seven Commissions of the Union and bear their titles. Some of the sessions dealing with specific topics were held jointly by two or more Commissions and are reported on in the more appropriate volume. Volume 8 contains the texts of the papers presented at the space radio research session organized by the Committee on Space Radio Research under the chairmanship of Prof. S. Silver, and the five papers prepared for presentation at the Satellite Communications Systems session organized by Commission VII on radio-electrons. Major aspects of space science and technology are discussed in this volume, and research workers in the optical and radio sciences and ionospheric and planetary physicists will find the stimulating discussions of great interest.

In addition to topics relevant to radio standards and measurements, Volume 1 contains a record of the recommendations adopted by the assembly. Volume 2 has sections devoted to models of the atmosphere, radioclimatology, the influence of terrain and vegetation on radio propagation, radiometeorology and cloud physics, and millimetre and submillimetre waves. J. A. Ratcliffe contributes the review article in Volume 3 on the ionosphere in which he summarizes the advances in ionospheric physics during 1960-63, and in Volume 4 reports on interesting discussions on lightning flashes, whistlers and other radio noises of terrestrial origin are given.

The rapidly developing field of radio astronomy, particularly that of radio and radar astronomy of the Moon

and planets, has led to greater knowledge of the physical state of the surfaces and gaseous atmospheres of several planets, and to increased accuracy in the measurement of astronomical distances. One of the conclusions to be drawn from the review of techniques and methods of observation in radio astronomy given in Volume 5 is that existing telescopes are primitive and that new instruments being planned and constructed, though better collectors of information, may introduce fresh difficulties because of their sophistication and complication. Volume 6 deals with circuit theory, information theory and electromagnetic theory and will appeal to electronic and electrical engineers and physicists with a good mathematical knowledge. Plasmas, both on the geophysical and astrophysical and on the laboratory scale, are discussed in Volume 7, together with the physics and applications of masers and lasers.

Conference proceedings are valuable as reference works, but are not usually of much use to the general scientific reader. *Progress in Radio Sciences, 1960-1963*, is something of an exception, because many of the review articles make excellent reading and are valuable introductions to contemporary physical and astrophysical problems.

S. WEINTROUB

VARIATION AND CONTROL THEORY

Sensitivity Methods in Control Theory

Edited by L. Radanovic. (Proceedings of an International Symposium held at Dubrovnik, August 31-September 5, 1964.) Pp. xiii+442. (London and New York: Pergamon Press, Ltd., 1966.) 84s. net.

Optimal Control Systems

By A. A. Fel'dbaum. Translated by A. Kraiman. (Mathematics in Science and Engineering: a Series of Monographs and Textbooks, Vol. 22.) Pp. x+452. (New York: Academic Press, Inc.; London: Academic Press, Inc. (London), Ltd., 1965.) \$16.

Optimal Adaptive Control Systems

By D. Sworder. (Mathematics in Science and Engineering: a Series of Monographs and Textbooks, Vol. 25.) Pp. xi+187. (New York: Academic Press, Inc.; London: Academic Press, Inc. (London), Ltd., 1966.) 68s.

THE theoretical study of control systems rests on the formulation of mathematical models. Having laid down the structure of a model, its parameters are estimated from data about the system to be controlled. The properties of such a model can then be investigated mathematically and used to predict the behaviour of the real system.

However, the model can never be more than an approximation to reality. Questions increasingly arise as to the consequences of the discrepancies between the two. Can the model itself be used to find out analytically whether, and how much, the behaviour of the system is sensitive to variation in the parameters of the model?

The papers in *Sensitivity Methods in Control Theory* are selected from those presented at a conference at Dubrovnik in 1964. As the excellent preface to the volume states: "There was no unified opinion as to what is meant by the term sensitivity". The papers are, however, grouped into sets discussing similar aspects of the question and four main objectives are listed by the editor.

The solution of the system equations is "imbedded" in a family of possible solutions and this concept may be related to that of stability. Sensitivity functions describe the departure of these additional solutions from the basic solution. Another set of papers is devoted to compensation for parameter variation and a further group to the synthesis of systems insensitive to variations of the model.