are surveyed. A foldout of the Kraftwerke Union Biblis 1000-MW(electric) plant control system is supplied. Heavy water reactors discussed include the steam generating and Canadian CANDU with direct digital control. Gas-cooled reactors, including the MAGNOX, advanced gas-cooled reactors, and high temperature gas reactors, are also considered. Finally, sodium-cooled fast reactor prototypes are surveyed.

The lumped constant property reactor stochastic model is developed in Chap. 6 to represent departures from the mean behavior. This is followed by a discussion of autocorrelation and cross-correlation functions and their Fourier transforms. Power spectral densities, the Rossi-alpha, and Feynmann-alpha experimental situations are examined and interpreted.

Chapter 7 deals with the safety and reliability of the reactor control system. Safety guidelines and philosophy are discussed. Logical and safety circuits are examined for monitoring parameters and event and fault trees. System reliability and the survival functions for different failure rate models are derived.

Nonlinear systems are studied in Chap. 8 using state space and its equations in the time domain. The Nordheim-Fuchs and the constant heat removal models are used to illustrate autonomous two-state systems. After a review of possible nonlinear trajectories, the Liapunov V function is introduced, discussed, and applied to the prompt jump model. Pontryagin's control theory is outlined. Reactor startup and xenon shutdown are addressed as optimal reactor control problems.

Analog computing is described in Chap. 9. Sample programs are given for a variety of examples, including low power kinetics, xenon shutdown, isotopic buildup of the transuranic elements, and nonlinear kinetics for the trajectories around an equilibrium point with Newton's law of cooling (illustrated on the cover). If the requisite electrical equipment is unavailable, but, instead, access to a digital computer is possible, the problems discussed here can still be addressed as they are interesting from the nuclear engineering standpoint.

With respect to typesetting errors, the failure rate is roughly a Gaussian centered about Chap. 3 with 85% of the total occurrences (about 25) in the first four chapters. The necessary corrections are reasonably clear if the reader has been following the development.

There are approximately 25 tables and 132 figures in the main text, with more included with the problems. The 123 problems are of high quality, pertinent, and a valuable supplement to the text. Numerous term project ideas are included. The 131 references give the reader quite adequate additional direction for consultation. There are never less than 7 problems in any chapter, and usually a dozen or more are available.

Overall, the text is excellent, quite readable, and has a lively style. It represents a significant contribution to the literature. This reviewer enjoyed using it in a graduate nuclear control systems course. It is recommended to the general American Nuclear Society membership as timely and important reading for an overall understanding of kinetics and control.

Clarence E. Lee is a professor in the Department of Nuclear Engineering at Texas A&M University. He is currently doing research on analytical and numerical methods in diffusion and transport theory, charged-particle transport, high temperature gas reactors (prismatic and pebble bed), fission product migration, and fast reactor accident analysis.

Simulation of Energy Systems
(Part 1 and Part 2)

Editor	Kenneth E. F. Watt
Publisher	Society for Computer Simulation, P.O. Box 2228, La Jolla, California (1980)
Pages	Part 1, 100; Part 2, 220
Price	$20.00 per book; $35.00 per set
Reviewer	Archie A. Harms

These two slim volumes of about 100 pages each represent Vol. 8 in the Simulation Councils Proceedings Series. The 20 papers contained herein, however, do not represent the proceedings of a conference but seem to be specifically prepared for Simulation Councils, Inc. The subjects covered are generally diverse but all touch upon some aspect of energy and power flow. Most papers have several authors who are associated with various industrial and academic institutions and generally represent the engineering sciences.

The word "system" in the title and in the papers is to be broadly interpreted. In some papers, system may be a compact energy conversion device such as a pump or a compressor while in others it may be the steam supply network of a nuclear reactor or a gas-water reservoir complex. Some of the papers deal with central problems of electrical utilities: unit expansion, optimal scheduling, and modeling of domestic power consumption patterns. Other papers discuss solar heating of buildings, queuing theory application to underground mining, the modeling of Saudi Arabia's water and power demand, and the exotic topic of the characterization of "boom-to-bust" towns.

The mathematical and conceptual level of these papers could best be described as fitting into the framework of operations research. Differential and/or integral equations describing continuity and balance relations together with empirical or semi-empirical algebraic relations are formulated and the system solved by computer to obtain time trajectories of various dependent parameters. Techniques such as linear and dynamic programming, optimization, and finite differences are the standard tools. Some papers, however, focus primarily on the descriptive aspects of their theme while others seem to assume even little in the area of computer programming and flow charting. These contrast with two papers on the theory and application of bond graphs.

The books are hardbound, the type is reproduced from typewriter-prepared manuscripts, and the figures are clear and consistent. Like the journal that carries this review, each paper has a biographical sketch and photograph(s) of the author(s).

In addition to the value of these volumes as an informative compendium on simulation of energy systems, they also seem to possess considerable merit as a listing of "what seems to work" at a practical level. As in other related areas of mathematical modeling, these papers provide a good

example of ingenuity that can be brought to bear in the analysis of energy systems.

Archie A. Harms is a professor of physics and engineering physics at McMaster University. He obtained his PhD in nuclear engineering at the University of Washington on a Ford Foundation Fellowship in 1969 and joined McMaster University thereafter.

Prior to his graduate studies, Professor Harms was engaged in computer simulation of hydroelectric power systems for a consulting engineering firm. His present research/teaching interests are in the general area of nuclear energy systems analysis. He has published and lectured widely on his research in Europe (East and West) and in North America, has served as a consultant to the U.N. International Atomic Energy Agency on several occasions, and was visiting scholar at the International Institute for Applied Systems Analysis in Austria.

Isotopes and Radiation in Research on Soil-Plant Relationships

Editor International Atomic Energy Agency, Vienna

Publisher Unipub, New York (1979)

Pages 660

Price $76.50

Reviewer Alexander Van Hook

This volume comprises the proceedings of an international symposium held in Columbo in December 1978 that was organized by the International Atomic Energy Agency and the United Nations Food and Agriculture Organization. The 45 papers contained in the volume (26 in English and the rest in French) were presented to approximately 70 attendees. Topical sessions included those on fertilizer use and efficiency (10 papers, mainly on ^{15}N studies of the nitrogen cycle), water relationships and ion movement (8 papers), organic residues in soil management (5 papers), micronutrients and nutrient availability (5 and 7 papers, respectively, mainly on studies of trace element uptake and utilization using radiotracer techniques), techniques and analytical methods (6 papers), and flooded (2 papers), and upland rice (2 papers). The larger sessions began with review papers giving a brief overview of the particular field. These are brief introductions, not comprehensive reviews, but are useful to a nonspecialist such as the present reviewer. The rest of the papers are short descriptions of specific applications of stable or radiotracer techniques to agricultural problems. As such, the volume should find its principal rest in the libraries of agricultural experiment stations. Wider circulation is unlikely, not only because of the specialized topical nature, but also because of the outrageous price.

W. Alexander Van Hook is professor of physical chemistry at the University of Tennessee–Knoxville. His research interests have focused mainly on the effect of isotopic substitution on the physicochemical properties of liquids and solutions.

Gravitation, Quanta and the Universe

(Proceedings of the Einstein Centenary Symposium held in Ahmedabad, India)

Editors A. R. Prasanna, J. V. Narlikar, and C. V. Vishveshwara

Publisher John Wiley & Sons, Inc., Somerset, New Jersey (1980)

Pages 326

Price $34.95

Reviewer Paul Zweifel

In 1979 a symposium was held at the Physical Research Laboratory at Ahmedabad, India, to celebrate the hundredth anniversary of the birth of Albert Einstein. The symposium, sponsored by the Indian Association for General Relativity and Gravitation, was attended by over 200 participants, some 15 from abroad.

To quote the Editorial Preface: "The symposium reflected the true spirit of Einstein's own concept of the unity of nature by bringing together scholars in different aspects of physics like relativity, astrophysics, field theory and foundations of quantum mechanics and statistical mechanics."

The proceedings are divided into four basic parts: Foundations and the Mathematical and Observational Aspects of Relativity; Cosmology and Astrophysics; Quantized Fields, Gauge Theories, and Foundations of Quantum Mechanics; Statistical Physics and Photoelectric Effect. In all, 22 papers are published in these different fields along with the discussion following the paper. There are a few general review-type papers such as "Einstein and the Unity of Nature" by V. V. Narlikar, "Cosmology in the Post-Einstein Era" by J. V. Narlikar, and talks on "Supergravity" by M. F. Sohnius, "Gauge Theories" by G. Rajasekaran, and the "Foundations of Quantum Mechanics" by V. Singh. But the majority of the papers are quite technical, representing recent research results with some connection to Einstein's work (come to think of it, it would be hard to think of an area of physics in which such a connection did *not* exist).

Because of the technical nature of the material, I would guess that few readers of this journal would be terribly interested in this book. However, those who would like to delve into the Einsteinian foundations of the latest developments in physics might find the book interesting.

Paul F. Zweifel is a University Distinguished Professor at Virginia Tech, where he is director of the Laboratory for Transport Theory and Mathematical Physics. His research interests include many areas of mathematical physics such as transport theory, the Boltzmann equation, and foundations of quantum mechanics. In 1972 he won the E. O. Lawrence medal.