

think about the challenges of improving health care, additional new technologies are sure to develop.

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Chaotic Vibrations: An Introduction for Applied Scientists and Engineers

Francis C. Moon

Wiley, New York, 1987. 309 pp.
\$39.95 hc ISBN 0-471-85685-1

The mathematical and scientific literature on nonlinear dynamics has grown rapidly over the past 15 years, and applications to many fields of science have been documented. However, many of the research papers (and even some of the review articles) are not really suitable for unguided use by physicists who are new to the subject. There is still a need for well-written textbooks on nonlinear dynamics at both the graduate and undergraduate levels.

Francis Moon was the first experimentalist to demonstrate and study chaotic dynamics in a wide variety of vibrating structures, such as driven beams. These phenomena are of considerable practical interest to engineers and designers of solid structures, and they also illustrate basic concepts of nonlinear dynamics exceedingly well. *Chaotic Vibrations* is of broader interest than its title might suggest. Moon's book is actually a general review of chaotic dynamics, which provides an excellent introduction to the subject and its literature for physicists and graduate students. Moon has made a particular effort to explain and interpret the mathematical literature at a level requiring primarily a basic understanding of ordinary differential equations and intermediate-level dynamics. He explains the subject and elucidates its jargon (strange attractors, homoclinic orbits, Arnold tongues, Lyapunov exponents, Poincaré maps) in a straightforward manner, with many explicit examples.

The book contains an excellent historical review of the development of chaotic dynamics, including summaries of many experiments involving not only vibrating systems but also fluids, electrical circuits, rotating objects and other systems. Moon thoroughly addresses two critical issues in chaotic dynamics that are often ignored, namely how to tell from experimental measurements when a system is chaotic and how to predict from a mathematical model of a physical system when it is likely to be chaotic.

Chaotic Vibrations includes an extensive bibliography through early 1987, a glossary with nonmathematical definitions of many terms, descriptions of simple vibrating chaotic systems ("toys") that the reader may wish to construct, and a set of numerical exercises that would enable the interested reader (or student) to learn the subject by experience.

This reliable and well-written book is certainly worthy of inclusion in physics as well as engineering libraries. It could be used as a supplementary text in mechanics courses at the advanced undergraduate or graduate level, or as a primary resource for a topical course on nonlinear dynamics.

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Tokamaks

John Wesson

Clarendon (Oxford U. P.),
New York, 1987. 309 pp.
\$85.00 hc ISBN 0-19-856328-0

As research in controlled thermonuclear fusion matures, much of it increasingly focuses on one promising device, the tokamak—the subject of the book *Tokamaks* by John Wesson. Besides Wesson, a distinguished plasma physicist, a number of well-known plasma theorists and experimentalists have contributed to making this a volume of unusually wide scope. To my knowledge, *Tokamaks* is the only book in this field that succeeds in covering such a complete spectrum of subjects. Included are discussions ranging from basic plasma physics to fusion reactions; plasma equilibrium, stability, confinement, instabilities and heating; plasma-surface interactions; diagnostics, and a description of major experiments.

The chapters on magnetohydrodynamic stability and instability are excellent summaries, including the unresolved physics issue of disruptions. Chapter 10, on plasma diagnostics, is a useful review for nonspecialists, and chapter 11 is a brief status report on current major experiments in the world. On the other hand, the discussion of neoclassical transport in chapter 4 omits the newer results of S. P. Hirshman and D. J. Sigmar, and of C. Chang and F. L. Hinton; nor is there any discussion of stochastic ripple transport.

An excessively broad range in a small book often results in an unduly cryptic style. This is true of *Tokamaks*. For example, taking only 33 pages to review plasma physics necessarily leads to a lack of depth. Only 18 pages on the complex subject of neo-

classical and anomalous transport guarantees excessive compression. Although the book is not suitable as an introductory treatise, it is an excellent handbook for specialists in magnetic-confinement fusion research who need acquaintance with other areas of the field. It will be a very useful book in the right hands as a very comprehensive reference.

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Nucleus: The History of Atomic Energy of Canada Limited

Robert Bothwell

U. of Toronto P.,
Toronto, 1988. 524 pp.
\$34.95 hc ISBN 0-8020-2670-2

The Chalk River laboratories of Atomic Energy of Canada Limited were well known to physicists after World War II as the home of high-quality research in nuclear physics. You might hope to learn something of the history of those activities in a book like this. But you would be disappointed. If you were interested in reactor physics and hoped to learn some technical details about the development of the very successful CANDU series of Canadian heavy-water reactors (which supply nearly half of the electric power generated in Ontario and widely varying amounts in other provinces), you would also be disappointed. But if you were interested in the political history of the development of nuclear power in Canada, then you would get a great deal of relevant information.

The author, Robert Bothwell, is a professor of history at the University of Toronto with an interest in the history of 20th-century Canada. He has previously written a biography of C. D. Howe, a longtime minister in the Canadian government who was responsible for starting Canadian nuclear research in World War II and for overseeing it for a long period thereafter. Thus it was natural that the president of Atomic Energy of Canada Limited would approach Bothwell to do a company history, and it was also probably natural that he would agree. He employed a fair number of assistants on the research for this book. I assume that this work was subsidized by AECL, but any such subsidies or other forms of assistance do not seem to have influenced his judgments.

Bothwell has built this history from his perusal of official documents, primarily those of AECL itself and the Canadian government, but also docu-

ments from the UK, the US and the province of Ontario. Therein lie both the strengths and weaknesses of the book. The book is heavy on considerations of policy. It is weak on what really happened at AECL.

The unlikely concatenation of circumstances that led to Canada's early start in nuclear research began with the French acquisition of the world's supply of heavy water for Frédéric and Irène Joliot-Curie's laboratory in Paris. This was followed by the flight of many of the laboratory personnel, some of them refugees from Nazi-occupied countries, together with the heavy water, to the UK. There personnel and heavy water were incorporated into the British program. In 1942 the British nuclear research program moved to Canada, partly to remove it from wartime disruptions, partly because Canada promised to be a source of uranium and heavy water and partly to be near the US research program and to benefit from cooperation with it. All this despite the fact that Canada was reputed to be (and was) a scientific backwater at the time.

Bothwell continues the story with the establishment of the program in the Montreal laboratories of the National Research Council of Canada, followed by its growth into a division of the NRC located at Chalk River, where it eventually was transformed into a separate crown corporation. Bothwell's lack of technical knowledge is ever present in these pages. He tries hard to use the correct technical terms, but he uses them awkwardly, and he usually fails to give an adequate set of technical reasons for many of the decisions that were made. But he does an excellent job of explaining who negotiated with whom and under what circumstances.

There is not a single hint in these pages that Chalk River was a first-rate laboratory for research in pure nuclear physics. To Bothwell, Chalk River had an assigned task, and that task was the development of nuclear power. Anything that detracted from that goal was obviously extravagant and a waste of money. Thus he misses the fact that Chalk River developed many highly competent nuclear physicists, that nuclear physics became the preeminent branch of Canadian physics in those postwar years, and that these physicists moved out, mostly to physics departments in Canadian universities, and greatly raised the quality and status of science in Canada, now no longer a scientific backwater. This is an intrinsic part of the history of AECL, of which it should be proud, but the president of AECL will remain ignorant of it if he relies on this book.

The only aspect of the physics research program treated in any depth is the proposal to develop the Intense Neutron Generator, a very-high-current accelerator that was considered a possible development path for a set of nuclear technologies that would present an alternative to the reactor. We learn from Bothwell about the political maneuvering concerning this proposal, but we never learn why it was a technically inter-

esting project, nor even its intended purpose. Thus the reader has no basis for judging the wisdom of the decision to deny funding.

The real history of AECL has yet to be written. When it is, this book will be a valuable source document concerning the politics.

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