influence ΔT_{ib}. Conflicting results were obtained, and the picture appeared to be hopelessly complicated until some definitive experiments by Holtz and Singer and by Henry established the dominating influence of small inert gas bubbles, which are always present in the wall cavities and in the circulating free stream in a reactor environment. The author gives a rather full account of these early experiments, but does not sufficiently emphasize the central conclusion stated above. Current practice is to assume that boiling is initiated when the wall temperature goes above the local saturation temperature in an LOF accident.

The second and third chapters are devoted to bubble growth, both far from any wall and at a heating surface. In liquid metals, bubble growth is quite fast, so that inertial effects are important. Several approximate solutions for isolated bubble growth are discussed. Unfortunately, practically no experimental data exist with which these data can be compared. Although pulsed x-ray techniques might be able to follow bubble growth in liquid metals, the problem has not been deemed sufficiently important to date to perform detailed studies. This is because a bubble growing in a reactor channel very quickly fills the cross section and therefore expands as a cylindrical bubble or a vapor slug. This aspect of bubble growth, which is the basis of the SAS code for sodium expulsion, is not treated.

The last three chapters deal with nucleate boiling, film boiling, and critical heat flux in liquid-metal pools. An excellent treatment is given of the Russian work in this field, which heretofore, except for the monograph by Subbotin et al., has been scattered throughout the literature. Most of these results have been correlated in terms of empirical dimensional equations, and theoretical approaches, such as the hydrodynamic theory (Zuber and others) of critical heat flux, are not particularly successful.

All in all, the author has performed a useful service in collecting a variety of scattered references covering the mechanics of liquid-metal pool boiling. The editing has been careful, although English and metric units (but not SI units) are mixed throughout. The specialist in the field will undoubtedly want to add this volume to his collection.

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About the Reviewers: S. George Bankoff is professor of chemical and nuclear engineering at Northwestern University, where he has been a member of the faculty since 1959. Dr. Bankoff received his early academic training at Columbia University and completed his graduate studies at Purdue University. He was associated with the Manhattan Project at both the Metallurgical Laboratories of University of Chicago and at the Hanford Engineering Works. He is currently the director of the Energy Engineering Council of the Technological Institute at Northwestern. He serves the U.S. Nuclear Regulatory Commission, Argonne National Laboratory (ANL), Los Alamos Scientific Laboratory, and the General Electric Company as a consultant. H. K. Fauske has been on the staff of ANL for more than two decades, with interests in heat transfer and fluid flow. He is presently associate director of the Reactor Analysis and Safety Division. Dr. Fauske received his academic training at the Bergen (Norway) Technic School and at the University of Minnesota.

Statistical Energy Analysis of Dynamical Systems: Theory and Applications. By Richard H. Lyon, with Chapter 15 written by Huw G. Davies. MIT Press, Cambridge, Massachusetts (1975).

This book is a comprehensive and well-written description of a relatively new method of dynamic analysis of coupled systems. Examples typically covered in the book are the steady-state, linear damped response of vibrating structures and acoustical systems, as well as combinations of the two. In the author's words, "SEA [statistical energy analysis] is the description of the vibrating system as a member of a statistical population or ensemble, not whether or not temporal behavior is random." This approach to the analysis of vibratory systems arises when one considers a trade-off in the analysis of complex systems. When performing a relatively thorough modeling of a real structure, such as a missile structure, numerous simplifications must be made when representing such components as riveted or welded joints, gusset plates, stringers, ribs, openings, etc., and the analyst must accept some uncertainty in the results. This is particularly true when higher vibrational modes are significant. As a trade-off, the analyst might consider the system description as having statistical properties as done in SEA. Uncertainty still remains in the predicted response, but two important advantages arise: The dynamic model can be greatly simplified, and a measure of the uncertainty can be developed. The latter is in the form of confidence intervals encountered in the theory of statistics.

SEA thus presents another approach the analyst can take when studying a system. This can be particularly advantageous in the early design stages. Furthermore, the method allows the use of experimental measurements on subsystems. As an alternate method of analysis, SEA has the above advantages but obviously has disadvantages. One of the strengths of this book is that both advantages and disadvantages are clearly pointed out.

To make full use of this book, the reader should have a good background in vibration theory and be familiar with impedance methods. Some knowledge of statistics is also helpful.

The style of the author makes the book easy to read. There is a good blend of discussion of the practical aspects of the topics as well as a thorough presentation of the mathematics. The book is divided into two parts, with a separate bibliography for each. Roughly speaking, Part I covers the theory of SEA, while Part II concentrates on applications. No problems are included at the ends of the chapters, so use as a textbook is limited. However, the book is primarily a monograph as an introduction of SEA to practicing engineers.

The contents of the book by chapter are:

Part I. Basic Theory

1. The Development of Statistical Energy Analysis
2. Energy Description of Vibrating Systems
3. Energy Shared by Coupled Systems
4. Estimation of Response in SEA

Part II. Engineering Applications

Sec. I. The Use of SEA in Preliminary Design

5. Response Estimation During Preliminary Design
6. Procedures of Statistical Energy Analysis
7. Estimation of Dynamic Response
8. Estimating the Energy of Vibration
9. Meaning and Use of SEA Parameters
10. Modeling the System

Sec. II. Evaluation of SEA Parameters

11. Parameter Evaluation—The Engineering Base of SEA
12. The Damping Parameter
13. Evaluating the Mode Count
14. Evaluating Coupling Loss Factors

Sec. III. Example of Response Estimation

15. Vibration of a Reentry Vehicle

This book will be appreciated by anyone involved in vibro-acoustical analysis of systems. There is little doubt that SEA, itself, will see more applications in the future.

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About the Reviewer: Raymond Brach has been a member of the faculty of the Aerospace and Mechanical Engineering Department of Notre Dame University since 1965, with special interests in dynamics, vibrations, acoustics, engineering design, and the application of statistics. Professor Brach's academic training began at the Illinois Institute of Technology and was completed at the University of Wisconsin in 1965.

Elements of Nuclear Reactor Design. By Joel Weisman, Ed. American Elsevier Publishing Co., Inc., New York (1977). 466 pp. $50.75.

This unique volume with contributions by nine authors ambitiously attempts to cover the major engineering sciences that form the basis for the analysis of a nuclear power reactor. The title may be somewhat misleading, since the emphasis throughout the 14 chapters is on the "elements" rather than on "design." Furthermore, only the nuclear core and the immediate vessel are discussed, and little mention is made of design and analysis for the balance of a power plant. Such a limitation on the scope of material is, of course, necessary to keep the book to a manageable size; however, the material covered still presents the authors with a formidable challenge. The sciences of materials, thermodynamics, reactor physics, shielding, heat generation and transfer, fluid flow, stress analysis, radioactivity, and reactor kinetics are all covered. The treatment of these subjects is explicitly oriented toward reactors, and is, for the most part, developed from first principles, presupposing little prior familiarity with the subjects on the part of the reader.

The book is divided into five major sections. The first section, "The Nuclear Reactor System," contains three chapters that review current power reactor concepts, reactor materials, and the thermodynamics of power cycles. None of these chapters requires any specialized engineering background to be understood, and all are well written and easily read.

However, the second section, "Nuclear Design," presumes that the reader has a familiarity with the diffusion equation and elementary reactor theory. In a chapter on reactor physics computations, the multigroup diffusion equation, its numerical solution, and the generation of group constants are well covered. Briefer sections on burnup calculations, reactivity control, and fast reactors complete this overview of core physics. The second chapter in this section presents neutron and gamma-ray shielding techniques, ranging from simple exponential attenuation to computer techniques. Unfortunately, the attempt to present so much material in one chapter has forced the description of some methods or concepts to become abbreviated and occasionally even vague.

In the third section, "Thermal and Fluid System Design," the three chapters on heat generation and transport, fluid flow, and heat transfer are oriented specifically to reactor core analysis. Taken as a whole, these chapters form an excellent condensation of the basics involved in thermal hydraulic analyses. The first chapter on heat generation and transport is well developed analytically, although the somewhat obsolete hot-channel factor concept is used extensively. The remaining two chapters on fluid flow and convective and boiling heat transfer make extensive use of empirical correlations and analytical results, often without mention of the restrictions on the results and, in the case of the analytical equations, without a hint of the derivation. While space limitations promote this philosophy of presentation and while some teachers believe the "plug and chug" approach to be the way to present the complex field of fluid flow and heat transfer, this approach is at odds with the developmental approach adopted in most of the other chapters.

The fourth major section of this volume deals with the mechanical and material aspects of reactor systems. A short introductory chapter presents an excellent summary of stress-strain relations and structural properties of materials starting from an elementary level. The next chapter then applies these concepts to vessel and pipe stress analyses. Since many nuclear engineering curricula do not traditionally include this topic, these two chapters offer a very useful distillation of elementary stress analysis as applied to nuclear systems. This section concludes with a very complete chapter on the material considerations of fuel element design.

The final section entitled "Safety Analysis" presents an introduction to three important areas of reactor design. The first chapter reviews the sources and type of radioactivity generated in a power reactor and discusses the release mechanisms of this radioactivity and their consequences. The second chapter in this section gives a very complete overview of the many thermal hydraulic problems encountered in the analysis of a loss-of-coolant accident. This chapter is very readable and has brought together for the first time much of the basic material used to treat this important problem. Finally, there is a chapter on reactivity insertion accidents in which reactivity feedback mechanisms, basic neutron kinetic models, and descriptions of various reactivity accidents are presented. This chapter, while not presenting the more advanced kinetic analysis techniques, serves as a good introduction to the topic.

Overall, the book is an interesting collection of special topics, each of which stands alone and can be read and used without reference to the rest of the book. Each chapter