BOOK REVIEWS

Selection of books for review is based on the editor's opinions regarding possible reader interest and on the availability of the book to the editor. Occasional selections may include books on topics somewhat peripheral to the subject matter ordinarily considered acceptable.

Applied Hydraulic Transients

Author M. H. Chaudhry

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Pages 503

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Reviewer Robert S. Wick

This book more than lives up to the expectations generated by its title. The book treats many applications and fields of interest. Although the use of the term "hydraulics" implies the emphasis might be on civil engineering applications, this book also should be of considerable interest to mechanical, petroleum, chemical, and nuclear engineers who design liquid flow systems. Of course, the traditional areas of interest to the civil engineer such as open channel flow, surge tanks, cavitation (and column separation), long line transients and hydroelectric plants are well covered. The emphasis is on presenting basic fundamentals and then illustrating how they are applied, rather than elaborate mathematical analysis for its own sake. The author has also emphasized the role of present-day computer capabilities in the solution of problems. For example, the appendixes include the Fortran listings and sample problems for three problems: analysis of transients in a pipeline caused by opening or closing a valve, analysis of transients in a pipeline caused by pumps, and frequency response of a series piping system. In addition, SI units are used extensively throughout the text.

After a brief introduction, the author carefully leads the reader from the basic conservation equations through the method of characteristics. The author introduces here the difference between implicit and explicit simulations of the appropriate equations along with the important concept of the Courant Number. This part is well documented and many references are given. Of course, one of the major problems in any algorithm for solving finite difference equations is treatment of the boundary conditions and junction conditions. Considerable space is devoted to this. At this point, the transients caused by centrifugal pumps in the system are treated, including lumped parameter models for the pump itself and the coupling of the pump or pumps to the flow in the piping for various modes of pump operation including start-up and failure. Next, the treatment of turbines (and their governers) in hydroelectric plants is discussed, along with penstocks. (Surge tanks are given a separate treatment.) Also, the problem of system stability is introduced. One of the attractive features of the author's presentation is the inclusion of case studies in all these areas, along with many significant references from the readily available engineering literature. At times references are made when necessary to less available (to the student) reports. The author also presents problems and additional references after a brief summary at the end of each chapter. This pattern of presentation (starting with fundamentals and ending with case studies) is used in each chapter covering a major topic. This reviewer's opinion is that this makes a very readable and logical approach for teaching the subject matter as well as for self-study by the practicing engineer.

A separate chapter is devoted to transients in long oil pipelines with emphasis on the role of the relatively high viscosity, compared to water, in the calculations. He also makes a point of the fact that the pipeline can be used for different grades of petroleum products; hence the possible variations in viscosity must be taken into account. The chapter on resonance in pressurized piping systems is a very good introduction to a complex problem. He introduces the terminology and the concepts of forced and self-excited oscillations, analysis in the time domain, analysis in the frequency domain, state vectors, transfer matrices, frequency response, and the impedance method. This chapter should be of considerable interest to a wide spectrum of engineers in addition to civil engineers.

There are separate chapters on transient cavitation and column separation, methods for controlling transients, surge tanks, and transient flows in open channel. The same systematic exposition described above is applied to these topics.

The author has also included an introductory chapter on hydraulic transients in nuclear power plants. He starts by introducing terminology and causes of transients. This is followed by a discussion of methods of analysis including the problem of formulating boundary conditions. He introduces the loss-of-coolant accident and the problems of two-phase transient flows. As usual he includes a good set of references (which I would consider advanced for senior level students). The case study interestingly enough has to do with waterhammer in the feedwater line at Indian Point. The inclusion of this chapter is well worthwhile as it will give the nonnuclear engineering student and practitioner an idea of the scope of problems in nuclear power plants.

In conclusion, this is a well-written and organized text from both the student's and practitioner's points of view. Some experience or background in numerical analysis of

partial differential equations would be very useful in "following through" on the material presented. This text is certainly far from elementary, and a reasonable level of mathematical sophistication will be required to take full advantage of it. The level, the emphasis on numerical methods, and the use of SI units make this a modern text.

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Fermi-I: New Age for Nuclear Power

Editor	E. Pauline Alexanderson
Publisher	The American Nuclear Society, La Grange Park, Illinois (1979)
Pages	454
Price	$27.80
Reviewer	Lloyd R. Zumwalt

This book gives the first full account of the history of the Enrico Fermi Atomic Power Project (Fermi-I) and reviews its contributions to the development of breeder reactors. Eighteen authors with intimate knowledge and involvement in the project cover the initiation, development, operation, and decommissioning of Fermi-I.

The book abounds with historical detail, is well dated and referenced, with many direct quotations from important individuals involved; lists of committee members, their affiliations, and the corporations involved, and a complete story of the initiation and changes in the two corporate bodies of the project. These bodies were the Atomic Power Development Associates (APDA) and the Power Reactor Development Company (PRDC). The appendixes are particularly rich in documentary detail and include a complete listing of member companies, boards of trustees, and officers and committees of the PRDC and APDA. Also given are the supervisory staff of the Fermi-I power plant, the APDA and PRDC licensed reactor operators, and a list of all APDA numbered reports. In addition, the appendixes include excerpts or reprints of loan agreements, pertinent letters from the ACRS and the U.S. Atomic Energy Commission (AEC) and a summary list of the final decommissioning costs.

The general reader who is not a historian, former participant, or a nuclear "old-timer" may want to "speed read" through much of this detail. He will nevertheless be rewarded with the narrative of the dramatic events in the life of the first large fast breeder power plant from its preconception with the formation of the Dow Chemical–Detroit Edison Study Group in 1950, until its decommissioning, completed in 1975. The reader should be able to perceive an exciting story that took place in an age of great expectations for nuclear power. Furthermore, the story is one of solid achievement and valuable learning experience in the time frame from 1950 to 1975.

The story begins with the formation of Dow Chemical–Detroit Edison Study Group. This group was indicative of the enthusiasm that industry had for nuclear power when the technology was shrouded by a veil of secrecy imposed by the Atomic Energy Act of 1946. The group studied hard and rapidly grew by adding many industrial associates, and by December 1954 became the APDA, which was incorporated on March 10, 1955. In the meantime, the group played an important role in the enactment of the Atomic Energy Act of 1954, which permitted a substantial declassification of the technology. Also, the study group had come to the conclusion that, although the technology of breeder reactors was less advanced and difficult research and development were ahead, more would be gained by efforts on a breeder which, from a long-range viewpoint, was the most desirable type of reactor.

The story continues. In response to an AEC invitation regarding power reactor demonstrations, Walker L. Cisler (President of Detroit Edison at the time), representing a group of power companies (later the PRDC), submitted in March 1955 a proposal to design, construct, own, and operate a 100-MW(electric) breeder power reactor. The design accompanying the study was by APDA. The AEC announced acceptance in August at the first U.N. Conference on Peaceful Uses of Atomic Energy. About a year later, the AEC issued a construction permit for a reactor plant at Lagoona Beach, Michigan (~25 miles from Detroit). The PRDC was incorporated on August 30, 1955, and Cisler was president of both PRDC and APDA. Chapters 3 and 4 detail the organization, members, personnel, and actions of these two corporate bodies, respectively.

Chapters 5 and 6 cover the financing of Fermi, the law affecting the Fermi Project, and the role of Fermi in the evolution of the AEC regulatory process for the nuclear industry. Some of this may be a bit dry for the general reader, but the next chapter on the obtaining of the construction permit is not.

Chapter 7, although written in a matter-of-fact, objective way, indicates the political drama that took place over the Fermi construction permit. This involved the conflict of two strong, prominent men, Admiral Lewis Strauss, Chairman of the AEC, and Senator Clinton Anderson of New Mexico, Chairman of the Joint Committee on Atomic Energy. The issue was an ideological one, of private versus public power, the latter being favored by Anderson. The reader will learn that Cisler had, in 1955, incurred the disfavor of Senator Anderson by testifying against the Gore Bill, which would have provided that the federal government construct six nuclear power plants (a sort of a giant nuclear version of the Tennessee Valley Authority). Cisler was, of course, an ardent exponent of private investment in nuclear power.

The reader will discover this struggle led to the first public intervention relative to the issuance of a construction permit. At the urging of Senator Anderson, at the end of August 1956, and led by the United Auto Workers and Walter Reuther, several labor unions and their officers intervened in less than 30 days of the issuance of the Provisional Construction Permit. The grounds for intervention were the questions of reactor safety and of the financial qualifications of the PRDC. However, as appears