frequent US representative at international conferences, including the 1958 Geneva Conference on the Peaceful Uses of Atomic Energy where he served as a technical advisor, and as US delegate to the 1961 IAEA Conference on Plasma Physics and Controlled Thermonuclear Fusion, in Salzburg, Austria. His PhD (1944) is from MIT.

MISLEADING TITLE

Title Optimal Shutdown Control of Nuclear Reactors

Author Milton Ash

Publisher Academic Press, 1966

Pages xiii + 169

Price $8.50

Reviewer J. R. Fredsall

The main fault of this book is its title; it is misleading. The book does not present optimum shutdown schedules applicable to nuclear reactors in general, nor does it give the methods that can be used to determine such schedules. Rather, it is a presentation of the dynamic programming method as applied to a simplified form of the general problem. Perhaps one is to infer that dynamic programming is used since R. Bellman is the editor of the series. However, a more representative title would have been that used for the author's recent *Nuclear Science and Engineering* article (1966) "Application of Dynamic Programming to Optimal Shutdown Control," [which is a re-presentation of the analysis contained in this book which, in turn, is a re-presentation of his document IA-988 (1964)].

Actually, the applicability of shutdown scheduling is so limited that it is difficult for me to see why anyone would want to write a book about this subject at all, except as an academic exercise. About 20 papers have been written on optimum shutdown control and, as far as I know, the methods have been tried on only a couple of reactors. The reasons for this apparent lack of interest are that the reliability and possibly safety of the reactor may be reduced, and that the function (e.g., electrical power or irradiation) may be adversely affected by rapid power cycling. (The author uses a submarine reactor as an example, but surely such a reactor would have complete xenon override as an operational requirement.)

On top of this, almost all of the present analysis methods used for deriving optimum shutdown control methods demand a simplified phrasing of the problem. Thus, samarium, prompt and/or delayed temperature coefficients, and flux period limits have been ignored. This has been realized by the author when he states that solution of such a problem by dynamic programming would "demand the services of million-word core-memory computers possessing nanosecond arithmetic and memory access times . . . ."

However, this book does have value if viewed as an introduction to the shutdown scheduling problem with emphasis on the dynamic programming method of solution. As such, the book would be useful to the budding nuclear-systems analyst or to the nuclear technologist who wishes to learn something about dynamic programming. The book is well written and gives a succession of example problems that leads to a good understanding of the final method used to solve the problem. A fair amount of background information is also included that gives the reader insight into the effect of xenon transients on reactor operation.

The author even includes a listing of his digital computer code that was developed to solve this problem—a rather unorthodox inclusion for a book like this, but it is perhaps of interest to those who do not have access to the document IA-988. Also of interest are the experimental results of a run on the Israeli IRR-1 reactor using the author's derived shutdown control schedule.

About one and one-half chapters of this book are devoted to discussing the use of Pontryagin's maximum principle as an alternative to the dynamic programming method of problem analysis. Unfortunately, the essence of this discussion is that dynamic programming provides the best approach for many classes of problems, including reactor shutdown optimization. This argument is rather questionable, since the recent works of Roberts and Smith (University of California) show that the use of the maximum principle leads to results that are as good as, if not better than, the results presented here. Had this information been available, I'm sure the author would not have been able to underrate the use of the maximum principle to such an extent.

J. R. Fredsall has been with the Australian Atomic Energy Commission for the past two and one-half years, and is engaged in the assessment of possible suitable reactor systems for Australia. His interest in reactor optimization was developed during the three years he worked as an operational physicist on the Hanford production reactors. He received BS and MS degrees in engineering from the University of Washington.

DEMONSTRATED SUCCESS

Title Handbook of Metal Powders

Editor Arnold R. Poster

Publishing Reinhold Publishing Corporation, 1966

Pages x + 274

Reviewer R. W. Fraser

The editor's scope in preparing this book was a review which dealt with the types of powders available, their source of supply, their properties, the available literature, and the methods used to test and characterize them. The book is divided into five sections:

1) Characteristics, testing and applications of metal powders

2) Data on commercially available metal powders

3) Suppliers of powders, listed according to metal element and alloy

4) Suppliers listing, including address and statement of activities

5) Annotated Bibliography of characteristics and testing of metal powders.

Section 1 consists of ten chapters which discuss the characteristics of individual powder particles and bulk powders, and the methods of measuring these characteristics (average size, size distribution, surface area, density, and flow properties).