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Book Review

Nuclear Reactor Kinetics. By Milton Ash, McGraw Hill, (1965), 415 pages, $19.50.

Though entitled *Nuclear Reactor Kinetics*, a more appropriate title for this book would be "Zero Power Nuclear Reactor Kinetics." Only a small part of the book is devoted to specific kinetics effects associated with power reactors per se. Nevertheless, many general methods applicable to any reactor type are discussed. The book is primarily recommended as an excellent and exhaustive treatise for those who are academically inclined and desirous of knowing all the ramifications of the zero power neutron kinetics equations.

The first two chapters are devoted to the neutron kinetics equations and their analytic solutions under a variety of conditions. It is convenient to have in one place the various formulae for the reactor power behavior corresponding to given reactivity functions. The next two chapters progress from elementary transfer function stability concepts to more advanced methods borrowed from classical mechanics.

In the middle there is some digression from the title. For example one finds a detailed discussion of the motion of an electron in an electromagnetic field. Also there is a thirteen-page Monte Carlo calculation of neutron shielding which one might have expected to find in a shielding book. However, these are offered as examples analogous to related techniques one uses in reactor kinetics. Perhaps in time to come there will be sufficient applications in reactors that we will not have to seek elsewhere for illustrations.

In the latter part of the book a chapter on control theory from a mathematician's point of view is interesting. Following this is a lucid discussion of spatially dependent kinetics. Finally, a few reactor prototypes are singled out for discussion of their kinetic behavior. Judging by the long discussion of nuclear rocketry and none on PWR's, no attempt was made to apportion space according to the current popularity of various types.

This half chapter which reaches into outer space is indicative of the up-to-date nature of this book. One should not be misled by frequent examples from very old BWR's or fast reactors, because these are still good illustrations of the kinetics problems designers face. The author's frequent use of examples helps hold the attention of readers not capable of continuously assimilating abstract mathematical concepts.

As pointed out in the preface, this is a scholarly treatise on reactor kinetics from a mathematical physics point of view. Furthermore it is intended primarily for the graduate student with a strong background in mathematics and reactor physics. It is not intended for the practical reactor operator or design engineer, who, incidentally, would be shocked at the positive $46.33 step reactivity example in the spatial effects chapter. However, this book is a worthwhile addition to the library of the theoretically research minded reactor physicist in addition to its obvious educational uses.

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About the Reviewer: Joseph A. Thie is a consultant to the reactor industry, having served in this capacity since 1960. In former years at the Argonne National Laboratory he pioneered in BWR development. He has worked extensively in fields of reactor design, experimentation, and operation. Books on physics experiments, reactor kinetics and reactor safety are among his publications.