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# Mathematical Methods in Nuclear Reactor Dynamics

ZIYA AKCASU, GERALD S. LELLOUCHE,  
and LOUIS M. SHOTKIN

ACADEMIC PRESS

# Mathematical Methods In Nuclear Reactor Dynamics

**Yicheng Fang**

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## **Mathematical Methods In Nuclear Reactor Dynamics:**

**Mathematical methods in Nuclear reactor Dynamics** Ziya Akcasuh, 2012-12-02 Mathematical Methods in Nuclear Reactor Dynamics covers the practical and theoretical aspects of point reactor kinetics and linear and nonlinear reactor dynamics. The book, which is a result of the lectures given at the University of Michigan, is composed of seven chapters. The opening chapter of the book describes various physical phenomena influencing the temporal behavior of neutrons to provide insights into the physics of reactor dynamics and the interrelationships between various diverse phenomena. The text then presents a set of equations called the point kinetic equation, which describes the time behavior of the total power generated in the medium. The book also provides a short discussion on Gyftopoulos' modification and Becker's formulation. The next chapters explore the exact methods for solving the feedback-free point kinetic equations for a number of reactivity insertions and the validity of the various approximate methods of solution. The book also examines the derivation of models for a certain reactor type and briefly discusses the validity of these models in certain cases against experimental data. A chapter focuses on a concise presentation of the stability theory of linear systems with feedback. Lastly, the concepts of stability in nonlinear reactor systems and the criteria for asymptotic stability in the large as well as in a finite domain of initial disturbances are covered in the concluding chapter. The text is an ideal source for nuclear engineers and for those who have adequate background in reactor physics and operational and applied mathematics.

**Mathematical Methods in Nuclear Reactor Dynamics [by] Ziya Akcasu, Gerald S. Lellouche [and] Louis M. Shotkin** Ziya Akcasu, 1971 Fractional Calculus with Applications for Nuclear Reactor Dynamics

Santanu Saha Ray, 2015-07-29 Introduces Novel Applications for Solving Neutron Transport Equations. While deemed nonessential in the past, fractional calculus is now gaining momentum in the science and engineering community. Various disciplines have discovered that realistic models of physical phenomenon can be achieved with fractional calculus and are using them in numerous ways. **Neutron Dynamics and Control**, 1966 Mathematical

Nodal Method for Energy-space-time Nuclear Reactor Dynamics Thuy Trong Le, 1987 **Scientific and Technical**

**Aerospace Reports**, 1971 Fractional-Order Models for Nuclear Reactor Analysis Gilberto Espinosa Paredes, 2020-10-22

Fractional Order Models for Nuclear Reactor Analysis presents fractional modeling issues in the context of anomalous diffusion processes in an accessible and practical way. The book emphasizes the importance of non-Fickian diffusion in heterogeneous systems as the core of the nuclear reactor as well as different variations of diffusion processes in nuclear reactors, which are presented to establish the importance of nuclear and thermohydraulic phenomena and the physical side effects of feedback. In addition, the book analyzes core issues in fractional modeling in nuclear reactors surrounding phenomenological description and important analytical subdiffusive processes in the transport neutron. Users will find the most innovative modeling techniques of nuclear reactors using operator differentials of fractional order and applications in nuclear design and reactor dynamics. Proposed methods are tested with Boltzmann equations and non-linear order models.

alongside real data from nuclear power plants making this a valuable resource for nuclear professionals researchers and graduate students as well as those working in nuclear research centers with expertise in mathematical modeling physics and control Presents and analyzes a new paradigm of nuclear reactor phenomena with fractional modeling Considers principles of fractional calculation methods of solving differential equations of fractional order and their applications Includes methodologies of linear and nonlinear analysis along with design and dynamic analyses

**Variational Methods in Nuclear Reactor Physics** Weston M. Jr. Stacey, 2012-12-02 Nuclear Science and Technology Volume 10 Variational Methods in Nuclear Reactor Physics presents the mathematical methods of a variational origin that are useful in obtaining approximate solutions to science and engineering problems This book is composed of five chapters and begins with a discussion on the variation principles for physical systems described by both inhomogeneous and homogeneous equations to develop a generalized perturbation theory Chapter 2 deals with the applications of variational estimates and generalized perturbation theory to neutron transport problems Chapter 3 covers the variation principles of the Lagrangian form that are constructed for a general linear time dependent process and for the specific case of the P1 neutron kinetics equations Chapter 4 presents the general procedure for the variational derivation of synthesis approximations and their applications to problems in reactor physics This chapter also examines the relationship of the spatial synthesis and finite element method and a hybrid method that combines features of both methods Chapter 5 describes the relationship of variation theory with the Hamilton Jacobi theory and with the optimization theories of the maximum principle and dynamic programming Nuclear physicists and researchers will find this text invaluable

**Nuclear Science and Engineering** ,1978 **Proceedings of the ... American Control Conference** ,1984 Energy Research Abstracts ,1982 Proceedings of the 1984 American Control Conference ,1984 **Measurement of the FNR Transfer Function Utilizing the Rod Drop Method** Frank J. Sweeney, 1975 *Handbook of Nuclear Reactors Calculants, Volume II* Yigal Ronen, 1987-06-30 **Publishers' Trade List Annual, 1980** Bobbs-Merrill Educational Co, 1980 **Nuclear News** ,1972 **Energy Research Abstracts** ,1982-12 Atomic Data ,1972-03 **Electrical and Power Systems Modelling and Simulation** J. Robert, W. Midvidy, 1989 **Bibliography of Publications by Members of the Several Faculties of the University of Michigan** ,1971

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