A STUDY OF NEUTRON WAVE AND PULSED NEUTRON PROBLEMS IN MULTIPLYING AND NON-MULTIPLYING ASSEMBLIES

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Thesis submitted to Indian Institute of Technology, Delhi for partial fulfilment of the Degree of

DOCTOR OF PHILOSOPHY

1971

ACKNOWLEDGEMENTS

I wish to express my deep sense of gratitude to Dr. A.K. Ghatak for his painstaking guidance, kind encouragement and inspiration without which the present work would not have been possible. I am greatly indebted to Dr. I.C. Goyal for his untiring help, useful advice and encouragement. Special thanks are due to Dr. N.K. Bansal for his help and many useful discussions.

I am grateful to Professor M.S. Sodha and Professor K.L. Chopra for their encouragement and interest in the present work.

I would like to thank Mr. D.P.S. Malik, Miss Shashi Bala, Miss S. Sobhana, Mr. Bimal Prasad and Dr. V.K. Tripathi for their help and useful discussions. Thanks are due to Mr. S.L. Aneja for efficient typing of the thesis and Mr. Balbir Singh for drawing the figures nicely.

Financial assistance during the period of the study from the Council of Scientific and Industrial Research, India is gratefully acknowledged.

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PREFACE

This thesis presents a study of Neutron Wave and Pulsed Neutron propagation in multiplying and non-multiplying assemblies. It consists of five chapters.

In the first chapter, we give an introduction to the subject of neutron thermalization. An outline of the work presented in other chapters, have also been given.

In Chapter II, the neutron wave propagation problem have been studied in one speed approximation (using transport theory) and in the multi-group approximation (using diffusion theory). In one speed approximation, analytical solutions of the neutron transport equation have been obtained in the case of complete back scattering and in the presence of complete back scattering plus isotropic scattering. The particular case corresponding to zero source frequency (which is essentially Milne problem) has also been studied. In the multi-group diffusion theory approximation, numerical calculations have been carried out to get the complete eigenvalue structure and the corresponding eigenfunctions of the neutron transport operator in diffusion approximation. Graphite, water and heavy water have been chosen as typical moderators for investigation. Results have been compared with the available experimental data.

The work of this chapter has appeared in the following publications:

(i) "One Speed Transport Theory Solution for Complete Back Scattering", Journal of Nuclear Science and Technology. To appear in June, 1971 issue.

(ii) "On the Complete Eigenvalue Spectrum for the Neutron Wave Problem in Multi-group Diffusion Theory", Nuclear Science and Engineering, 42, 171-178 (Nov., 1970).

(iii) "On the Continuum Modes in the Neutron Wave Propagation in Graphite", Journal of Nuclear Science and Technology. To appear in May, 1971 issue.

In Chapter III, we have studied the diffusion length problem in the presence of large absorption. The results are presented in a paper entitled:

"Analysis of Diffusion Length Problem in the Presence of Large Absorption". To appear in Journal of Nuclear Science and Technology.

In Chapter IV, the decay of a neutron pulse in a multiplying assembly has been studied analytically by using one term degenerate kernel. Exact numerical solutions have

been obtained by using realistic kernels. Part of the results are presented in the following paper:

"The Decay of Neutron Pulse in a Multiplying Assembly Using a Simple kernel", Journal of Nuclear Energy. To appear in May, 1971 issue.

In the last chapter we have considered the non-linear prompt neutron kinetics problem and corrections have been obtained to the time-dependent reactor power due to the excitation of higher spatial modes for a two region reactor using one group diffusion theory. Results have appeared in the following publication:

"Space Dependent Considerations in the Non-linear Prompt Neutron Kinetics of a Nuclear Reactor", Journal of Nuclear Energy, 24, 217-221 (1970).

CONTENTS