PROPAGATION OF NEUTRON WAVES IN CRYSTALLINE AND NON-CRYSTALLINE ASSEMBLIES

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A C K N O W L E D G E M E N T S

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P R E F A C E

The present thesis is mainly a study of neutron wave propagation through crystalline and non-crystalline assemblies. The work has been presented in the form of five chapters and an appendix.

Chapter 1 contains an introduction to the field of neutron thermalization, the reasons for undertaking the present study and an outline of what is contained in the subsequent chapters.

In chapter 2, the neutron wave propagation through a polycrystalline medium has been studied in the presence of complete back scattering plus isotropic scattering. The results have been obtained both in one-speed and multivelocity cases using Fourier transform technique and one-term degenerate kernel. The results of the above study appear in the following paper:

"Complete Backscattering Effects in Neutron Wave propagation Problem", Transport Theory and Statistical Physics, 2(4), 321, (1972).

Chapter 3 concerns the study of neutron wave propagation through beryllium oxide assemblies. The fundamental mode eigen-value of the neutron transport operator and the dispersion relation have been obtained

using multigroup diffusion theory and one term degenerate kernel. The results have been compared with previously reported theory and recent experimental results. The results of this chapter are reported in the following paper.

"Neutron Wave Propagation through Beryllium Oxide Assemblies", (to be sent for publication).

In chapter 4, we present the results of a series of calculations on neutron wave propagation through multiplying assemblies, using multigroup diffusion theory. Taking explicit account of slowing down process, the dispersion curve for a heavy-water natural uranium subcritical assembly has been studied and compared with different sets of available experimental data and previously reported theoretical calculations. The effect of different types of kernel on the fundamental mode has also been studied. The work reported in this chapter has resulted in the following publication:

"Study of Neutron Wave Propagation through a Subcritical Assembly", Journal of Nuclear Energy, 27, 441, (1973).

In chapter 5, we have carried out a study of decay of monoenergetic burst of fast neutrons through slab geometries, using one-speed transport theory. The effect of various boundary conditions viz., the exact

and Marshak boundary conditions have been studied and compared with the previously obtained results using Mark's boundary condition, the exact calculations and also some available experimental data. The variations of decay constant with slab thickness have been obtained in P_1, P_3 and double P_1 approximations. Part of the results of this chapter has been reported in the following paper:

"On the Transport of one-speed Neutrons", Proceedings of Nuclear Physics and Solid State Physics Symposium, B.A.R.C., Bombay. Vol. 14B, (1972).

Finally, in the appendix, we have reported the formulation of an expression for neutron scattering from a finite one dimensional chain with free ends and have shown how the elastic scattering cross section in this case differs from the cross section for a periodic chain. This work has been published in the following paper:

"Neutron Scattering from a Finite Linear Chain", Phys. Stat. Sol. (b), 49, K75 (1972).

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