Syllabus
NSEG 5124 Nuclear Reactor Analysis
(Fall 2015)

Description: Physical principles and computational methods for reactor analysis and design

Instructor: Prof. Alireza Haghighat, haghighat@vt.edu, (571) 858-3333

Time: Monday and Wednesday, 11:00 am-12:15 pm

Locations: NVC 219, Falls Church; BUR 123A, Blacksburg

Registration, Course ID: NVC CRN: 87441; Blacksburg CRN: 85393

Outline

Topics
Introduction – Nuclear reactors, purpose of the course
Review – Neutron interactions and cross sections
Differential scattering cross-section
Review - Fission chain and criticality
Introduction to neutral particle transport theory and equation
Derivation of diffusion equation from transport equation
Solving one-speed neutron diffusion equation for reactor applications (fixed-source/shielding, eigenvalue/criticality)
Finite-difference formulations and solution methods for the one-speed finite-difference diffusion equation
Multigroup diffusion theory
Finite-difference formulations and solution methods for the multigroup finite-difference diffusion equation
Analytical solution to multigroup diffusion equations for 1-region/2-region reactor criticality calculations
Homogenization for heterogeneous reactor cores

Grading:
Homework (problems and computer assignments) (25%), Exam #1 (20%), Exam #2 (20%), and Final Exam (35%)

Text
J. J. Duderstadt and L.J. Hamilton, Nuclear Reactor Analysis, Wiley and Sons, 1976, and Handouts

References:

- R. V. Maghreblian and L. J. Holmes, Reactor Analysis, McGraw Hill, 1960
- A. M. Weinberg and E. P. Wigner, The Physical Theory of Neutron Chain Reactors, The University of Chicago Press, 1958.
- M. Clark, Jr. and K.F. Hansen, Numerical Methods of Reactor Analysis, Academic Press, 1964.
- J.R. Lamarsh, Introduction to Nuclear Reactor Theory, Addison Wesley, 1966.
- R.J.J. Stammler and M.J. Abbate, Methods of Steady-State Reactor Physics in Nuclear Design, Academic Press, 1983.