

Chapter 1

Neutron Transport Equation

- derivation and inherent approximations.

Chapter 2

Genealogy of Approximations

- Isotropic
- Diffusion
- Multigroup
- Steady State
- Short Times ($\frac{\partial C_i}{\partial t} \approx 0$)
- Point Kinetics

Chapter 3

Zen and the Art of Space-Time Kinetics

- Matrix Formalism
- Makeup of the Matrix - sparse + stiff
- A design approach.

Chapter 4

Generating Intuition

- Time vs space.
- point kinetics - exponential behaviour
- matrix approach to point kinetics.

Chapter 5

Doing Time

- recast $\psi(t) = \sum \psi_i e^{\alpha_i t} \Rightarrow \psi(t) = e^{At} \psi(0)$
+ investigate truncation error of $\psi_{n+1}^* = \exp\left[\frac{A_n + A_{n+1}}{2} \Delta t\right] \psi_n^*$
- errors in evaluating e^{At} where α is $\ll 0$
- where Runge-Kutta fits in. \uparrow ramifications wrt. dominant eigenvalue.
- consistency, convergence + stability.
- A-stability by Dahlquist.
- strongly A-stable
- comment on $\alpha > 0$.

Chapter 6

Travelling Through a Plethora of Cornucopia

- genealogy of solution techniques
- modal vs nodal
- quasi-static
- time synthesis
- exponential transformations

Chapter 7

About A when it is non-constant

Chapter 8

BACKWARD

- final design thoughts

Appendices:

- Equation Summary
- Derivation of Basic Neutron Eqns.
- Reynolds Transport Theorem.
- Bibliography