ChE 641 Review for Final Exam

Turbulent Combustion (Gas Phase)

- Overall Strategy for Comprehensive Combustion Modeling
- Governing Equations
 - overall continuity
 - species continuity
 - energy
- Elliptic vs Parabolic Equations
 - types of boundary conditions needed
- Pressure
- Gridding
 - collocated vs. staggered
- TEACH algorithm
 - finite volume approach
 - solution algorithm
 - convergence methods
- SIMPLE algorithm
- Turbulence Effects on Fluid Dynamics
 - general effects on combustion
 - modeling approaches
 - $\cdot\,$ direct numerical simulation
 - · k-ε
 - · Reynolds stress model
 - algebraic stress model
- Chemistry-Turbulence Interactions
 - time scales
 - Why is this hard?
 - mixture fraction approach
 - · assumed-shape PDF
 - · flamelet
 - eddy dissipation approach
 - others
 - · Conditional moment closure
 - Transported PDF (like PaSR in each cell)

Turbulent Combustion (Gas and Solid Phases)

- Particle Flow Modeling
 - Lagrangian vs. Eulerian
 - PSI-Cell technique
 - \cdot source terms for gas phase
 - random walk model
 - cloud models
- Condensed Phase Reactions
 - evaporation
 - devolatilization
 - char reaction
 - energy equation
 - overall solution strategy
 - potential problems
- Turbulence-Chemistry Interactions with 2 phases
 - coal gas mixture fraction (η)
 - conservation equation for η
 - conserved scalar approach
 - joint PDF with f and η
 - intermittency
 - treatment of enthalpy (h, h_r)
- Treatment of NO_x in Turbulent

Combustion

- pathways of NO_x formation
- why use a different approach?
- species conservation equations
- concept of π_k
- PDF
- overall strategy for solution

Radiation

- Common terms
- Radiate Transfer Equation (RTE)
- Coefficients
- Path Length Dependence