MAE 770, Combustion of Reacting Flows

Project 2: Reacting-Gas Nozzle Flow, Re-Entry Conditions

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**Objective**: Write a program to solve the steady state quasi 1D reacting-gas nozzle problem in re-entry-like conditions for 5 species air and thermal nonequilibrium. The problem setup is described in detail in the project prompt. One difference is that this work uses a modification of the McBride curve fits for computing non-equilibrium thermodynamics instead of other thermodynamic state descriptions.

**Spatial Discretization**: Finite Volume with upwinding – **LDFSS(**primary) and **Van Leer**(for comparison).

**Integration/Solution Process**: Explicit handling of fluid equation system, implicit handling of thermochemical nonequilibrium source terms. Solution is initialized and advanced in pseudo-time until the convergence criterion is met.

**Chemistry:** 5 species air with 5 reactions for the dissociation of O­2, N2, and NO, and the production of NO. The standard Arrhenius form is used for the forward reaction rates, and the equilibrium reaction rate was determined using the given expression. Chemical source terms are set to 0 for temperatures below 1000K, to remain within the limits of the curve fit.

**Thermal Nonequilibrium**: