

AME 598i
Examination 1
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1. At $t = 0$ s, a stoichiometric mixture of H_2 and O_2 (that is for every mole of O_2 initially, there exists two moles of H_2) is enclosed in a fixed volume of 1000 cm^3 at $P = 1\text{ MPa}$, $T = 1000\text{ K}$.
 - (a) Using the detailed reaction mechanism developed in homework, generate a plot of $T(t)$ and, on the same plot $[H_2O](t)$ and $[OH](t)$. Make sure your plot elucidates all of the features of the development and ultimate equilibration.
2. Consider a simplified combustion model for an unsteady system with spatial homogeneity, Arrhenius kinetics and lumped convection:

$$\frac{dT}{dt} = \alpha(1 - T)e^{-\theta/(\kappa+T)} - \beta T, \quad T(0) = 0.$$

If $\alpha = 10$, $\kappa = 1/10$, $\beta = \theta = 1$, find all equilibrium temperatures and their stability. Numerically determine and plot $T(t)$.