

AME 598i
Prof. J. M. Powers
Homework 5
Due: Friday, 21 February 2003

1. Consider a reaction mechanism for the combustion of H_2 with O_2 as given by Singh, *et al.*¹ in their Table 1. This is available on the links section of the course web page. Consider combustion in a volume which is a cube, whose side is of length 200 mm , of a gas which has initial mole fractions of $X_{H_2} = 0.1$, $X_{O_2} = 0.1$, $X_{Ar} = 0.8$, and an initial pressure and temperature of 1 MPa and 1000 K ,
 - (a) For adiabatic, isochoric combustion, determine the variation of all species concentrations, temperature, pressure, and time scales of reaction as functions of time; give computer-generated plots on logarithmic scales. Plot all species concentrations on a single plot. Plot all time scales on a single plot.
 - (b) Repeat the previous problem if there is lumped heat transfer from the volume to the surroundings. Take the heat transfer coefficient to be $h = 10\text{ W/m}^2/\text{K}$ and the far field temperature to be 300 K .

¹Singh, S. Rastigejev, Y., Paolucci, S., and Powers, J. M., 2001, "Viscous detonation in $H_2 - O_2 - Ar$ Using Intrinsic Low-Dimensional Manifolds and Wavelet Adaptive Multilevel Representation," *Combustion Theory and Modeling*, Vol. 5, pp. 163-184.