ME 456
Prof. J. M. Powers
Homework 3
Due: Friday, 12 February 1999

1. Using at least two references, write a document of less than one page describing one modern experimental technique for measuring species concentrations in combusting systems. Cite all references. Use the LaTeX text processor. Post your report on the world wide web as a pdf file. Also give me a hardcopy.

2. Consider an eight species, thirty-four reaction mechanism for the combustion of H_2 with O_2 as found in the first thirty-four reactions listed by Maas and Pope[1] in their Table 1. For isothermal ($T = 1500\ K$), isochoric ($V = 2000\ cm^3$) combustion of a gas which is initially composed of $N_{H_2} = 2\ mol$, $N_{O_2} = 3\ mol$,

   (a) determine the variation of all species concentrations as functions of time; give computer-generated plots on logarithmic scales, using an implicit integration scheme,

   (b) repeat the above using an explicit integration scheme,

   (c) find the variation of pressure with time, assuming ideal gas behavior,

   (d) find the net heat transfer in erg to the volume.

   Use the thermochemical calculator (http://adam.caltech.edu/tcc) to estimate enthalpies. Write your code which solves the rate equations in a Fortran 77 program and utilize the dlsode subroutine to integrate the equations. Include a copy of your program (leaving out dlsode) as an appendix to your homework.

[1] Maas, U. and Pope, S. B., 1992, "Simplifying Chemical Kinetics: Instrinsic Low-Dimensional Manifolds in Composition Space," *Combustion and Flame*, Vol. 88, pp. 239-264.