King Fahd University of Petroleum & Minerals
Chemical Engineering Department
CHE 560 –Numerical Methods in Chemical Engineering
2010 - 2011 (102)

HW#8
Due: Sunday, 22-May-2011

Consider the following system of nonlinear PDE's representing a modified version of HW#7. In this problem unsteady state non-isothermal reaction and diffusion in a catalytic slab:

$$\frac{dy_1}{dt} = \frac{d^2 y_1}{dz^2} - \phi\, e^{-\varepsilon\left[\frac{1}{y_2}-1\right]} y_1^2$$

$$\frac{dy_2}{dt} = \frac{d^2 y_2}{dz^2} + \gamma\,\phi\, e^{-\varepsilon\left[\frac{1}{y_2}-1\right]} y_1^2$$

$t = 0$	$y_1 = 0,\ y_2 = 1$
$t > 0,\ z = 0$	$\frac{dy_1}{dz} = \frac{dy_2}{dz} = 0$
$t > 0,\ z = 1$	$y_1 = y_2 = 1$

Perform the following:

(a) Discritize the PDE's specially using Chebyshev collocation method and temporarily using backward Eular method.
(b) Derive the resulting residual equations.
(c) Derive the Jacobian Matrix.
(d) Using h = 0.01 and N = 16, $\phi_1 = 3.0,\ \varepsilon = 1$ and $\gamma = 0.5$, solve this problem using Code_7.f and send your program by e-mail as yourname-HW8.f.