

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

HW#7

Due: Sunday: 15-May-2011

Consider the following system of nonlinear BVP's representing the non-isothermal reaction and diffusion in a catalytic slab:

$$\frac{d^2 y_1}{dz^2} - \phi_1 e^{-\varepsilon \left[\frac{1}{y_2} - 1 \right]} y_1^2 = 0$$

$$\frac{d^2 y_2}{dz^2} + \gamma \phi_1 e^{-\varepsilon \left[\frac{1}{y_2} - 1 \right]} y_1^2 = 0$$

$$\begin{array}{ll} z = 0 & \frac{dy_1}{dz} = \frac{dy_2}{dz} = 0 \\ z = 1 & y_1 = y_2 = 1 \end{array}$$

Perform the following:

- (a) Discretize the BVP's using Chebyshev collocation method and derive the resulting residual equations.
- (b) Derive the Jacobian Matrix.
- (c) Using $N = 16$, $\phi_1 = 3.0$, $\varepsilon = 1$ and $\gamma = 0.5$, solve this problem using Code_6-2BVPs.f and send your program by e-mail as yourname-HW7.f.