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

HW#4

Due: Tue. 3-April-2011

For the IVP's example solved in class:

$$\frac{dy_1}{dt} = -\phi_1 y_1$$
$$\frac{dy_2}{dt} = \phi_1 y_1 - \phi_2 y_2^2$$

Modify code_3.f to include the following methods

(a) (10 points) 1st-order explicit Euler (for IMETHOD = 4 include new subroutine EXPEULER)
(b) (15 points) 1st-order implicit Euler (backward Euler) (for IMETHOD = 5 include new subroutine IMPEULER)
(c) (15 points) 4th-order Runge-Kutta-Gill (for IMETHOD = 6 include new subroutine RKG4)

Note that for part (b) subroutine residuals and jacobian must be modified.

Send this first program as yourname-HW4-part1.f

(d) (30 points) If the IVP's are linear :

$$\frac{dy_1}{dt} = -\phi_1 y_1$$
$$\frac{dy_2}{dt} = \phi_1 y_1 - \phi_2 y_2$$

Modify code_3.f to solve the above problem using 1st-order implicit Euler (backward Euler). In this case, you have to solve a system of linear equations at each time step of the form:

$$\underline{\underline{A}} \cdot \underline{y} = \underline{B}$$

Define exactly in your analysis what are the matrix and the right hand side vector.

Send this second program as yourname-HW4-part2.f