Homework 1

Ch En 263 – Numerical Tools

Due date: 30 Apr. 2020

Instructions

- Complete these problems by hand. Scan your assignment and submit it through Learning Suite with the naming convention: LastName_FirstName_HW01.pdf. Note that you will use this naming convention for future assignments.
- \bullet Warning: the LS assignment will close promptly at 11:59 pm and late assignments will only receive 50% credit.
- Please report how long it took you to complete the assignment (in hours) in the "Notes" section on Learning Suite.

Problems

1. Classify the following equations as single/system, coupled/uncoupled, linear/nonlinear, differential/integral/algebraic:

(a)

$$\frac{1}{\sqrt{x_2}} + 5\exp(x_2) = 0$$
$$x_1 + 3x_1^2 + x_1^3 = 3$$

(b)

$$6x_1 + 2x_2 = 3$$
$$x_1 + 3x_2 = \sin(\pi/3)$$

(c)

$$\left(\frac{dy}{dt}\right)^2 + 2y = 0$$

2. Find an analytical solution to the system of equations,

$$11x_1 + 3x_2 = 41$$

$$4x_2 + 2x_3 = 0$$

$$3x_1 + 2x_2 + 7x_3 = 24$$

3. Classify the following equations as single/system, coupled/uncoupled, linear/nonlinear, differential/integral/algebraic: (a)

$$\frac{dA}{dt} = -k_1 A B^2$$
$$\frac{dB}{dt} = -k_1 A B^2$$
$$\frac{dC}{dt} = k_1 A B^2$$

(b) $\begin{bmatrix}
-2 & 4 & 3 \\
1 & -4 & 5 \\
6 & 8 & -1
\end{bmatrix}
\begin{bmatrix}
x_1 \\
x_2 \\
x_3
\end{bmatrix} =
\begin{bmatrix}
-3 \\
2 \\
9
\end{bmatrix}$ (c) $2x^{2/3} + y^{2/3} - 9^{1/3} = 0$

4. Find the analytical solution for \boldsymbol{x} to the matrix equation $\boldsymbol{A}\boldsymbol{x} = \boldsymbol{b}$ where

$$\boldsymbol{A} = \begin{bmatrix} 2 & 3 & 0 \\ -1 & 4 & -5 \\ 6 & 0 & 4 \end{bmatrix} \quad \text{and} \quad \boldsymbol{b} = \begin{bmatrix} -11 \\ -31 \\ 10 \end{bmatrix}$$

 $\frac{x^2}{4} + \sqrt{y} - 1 = 0$