Cairo University- Faculty of Engineering
Structural Engineering Department
Computer and Numerical Analysis – Spring 2016

Assignment (2)

Due Date: 10/5/2016

1- Using the power method and the inverse power method find the Eigen values and Eigen vectors for Matrix A: $A = \begin{bmatrix} 6 & 2 \\ 2 & 3 \end{bmatrix}$.

2- Employ Hotelling's method to find all the Eigen values and Eigen vectors for Matrix B: $B = \begin{bmatrix} 7 & 4 & 1 \\ 4 & 4 & 4 \\ 1 & 4 & 7 \end{bmatrix}$.

3- For the equation: $f(x) = 10 + 20x - 42x^2 + 33x^3 - 9x^4 + x^5$
   i. Determine all the roots graphically.
   ii. Use bisection and false position methods to determine the root to $\epsilon_a = 10\%$. Employ initial guesses of $x_l = 0.5$ and $x_u = 1$.

4- Determine the positive real root of $\ln(x^4) = 0.7$:
   i. Analytically.
   ii. Graphically.
   iii. Using three iterations of the false-position and bisection methods with initial guesses of 0.5 and 2. Compute the approximate error ε_a and the true error ε_t after each iteration. Comment on the results.

5- Determine a root of $f(x) = -x^2 + 1.8x + 2.5$:
   i. Graphically.
   ii. Fixed-point iteration method.
   iii. Newton-Raphson method.
   Use $x_0 = 5$, perform computations until ϵ_a is less than 0.05%.

6- Locate the first positive root of $f(x) = \sin x + \cos(1 + x^2) - 1$ using four iterations of the Secant method with initial guesses:
   i. $x_i^{-1} = 1.0$ and $x_i = 3.0$.
   ii. $x_i^{-1} = 1.5$ and $x_i = 2.5$.
   iii. $x_i^{-1} = 1.5$ and $x_i = 2.25$.
   Use the graphical method to explain your results.

7- Determine the real root of $x^{3.5} = 80$, with the modified secant method to within $\epsilon_a = 0.1\%$ using an initial guess of $x_o = 3.5$ and $\delta = 0.01$.

8- Determine the roots of the following simultaneous nonlinear equations using (i) fixed-point iteration and (ii) the Newton-Raphson method:

$$y = x^2 + 1$$

$$y = 2 \cos x$$

Use a graphical approach to obtain initial guesses.