Math 4340 – Numerical Methods

Homework 6.2

Due Tuesday, September 29, 2015

Instructions: Check your finite difference expressions for #1 and #2, using the standard Taylor’s series chart.

1. Use f(x-2h), f(x) and f(x+3h) to develop a finite difference approximation for the first derivative and for the second derivative, using the variation of coefficients approach. Determine the order of accuracy and the leading order error terms for each approximation.

2. Use f(x), f(x+h), f(x+2h) and f(x+3h) to develop a finite difference approximation for the third derivative. Determine the order of accuracy and the leading order error term for the approximation.

3. Determine the optimal step size for a finite precision machine with machine epsilon ε

for the double forward difference approximation to the first derivative given below:

$$\frac{-f\left(x+2h\right)+4f\left(x+h\right)-3f\left(x\right)}{2h}=f^{'}\left(x\right)-\frac{f^{'''}\left(c\right) h^{2}}{3}$$

4. Determine the optimal step size for a finite precision machine with machine epsilon ε for the central difference approximation to the second derivative given below:

$$\frac{f\left(x+h\right)-2f\left(x\right)+f\left(x-h\right)}{h^{2}}=f^{''}(x)+\frac{f^{''''}\left(c\right) h^{2}}{12}$$