Lecture 1:

*) Reasons to use numerical method.

Lecture 2:

*) True error = True value - Approximate error

*) Relative true erre = $\frac{\text{True error}}{\text{True value}}$

Lecture 3:

*) Approximate error = Present approximation - Previous approximation

*) Relative approximation error = $\frac{\text{Approximate error}}{\text{Present approximation}}$.

*) $|\epsilon_a| < \epsilon_s$; $|\epsilon_a| < 0.5 \times 10^{2-m}$ %

$|\epsilon_a|$ ↓ error in %

ϵ_s ↓ Tolarence

*) error% < 5% means it has 1 significant bits

" % < 0.5% " " " 2 " "

" % < 0.05% " " " 3 " " .

~~*)~~

Lecture 4:

*) Round off ennon

*) Truncation ennon

Lecture 5:

*) Bin → Dec

*) Dec → Bin

*) Taylon senees:

$$\rightarrow \cos(x) = 1 - \frac{x^2}{2!} + \frac{x^4}{4!} - \frac{x_6}{6!} + \dots$$

$$\rightarrow \sin(x) = x - \frac{x^3}{3!} + \frac{x^5}{5!} - \frac{x_7}{7!} + \dots$$

$$\rightarrow e^x = 1 + x + \frac{x^2}{2!} + \frac{x^3}{3!} + \dots$$ [5 tenms shown]

*) General taylon series:

$$\rightarrow f(x+h) = f(x) + f'(x)h + \frac{f''(x)h^2}{2!} + \frac{f'''(x)h^3}{3!} + \dots$$

*) Maclaunin senies:

$$e^x = 1 + x \cancel{x} + \frac{x^2}{2!} + \frac{x^3}{3!} + \dots$$

*) FDD:

$$f'(x) = \frac{f(x+\Delta x) - f(x)}{\Delta x}$$

Lecture 6:

*) BDD:

$$\rightarrow f'(x) = \frac{f(x) - f(x-\Delta x)}{\Delta x}$$

*) CDD:

$$\rightarrow f'(x) = \frac{f(x+\Delta x) - f(x-\Delta x)}{2\Delta x}$$

*) Derive FDD, BDD from taylor series.

Lecture 7:

*) Higher order/second order derivative of FDD & BDD.

$$\rightarrow \text{FDD}: f''(x) = \frac{f(x_{i+2}) - 2f(x_{i+1}) + f(x_i)}{(\Delta x)^2}$$

$$\rightarrow \text{BDD}: f''(x) = \frac{f(x_{i-2}) - 2f(x_{i-1}) + f(x_i)}{(\Delta x)^2}$$

~~*) Discrete functions~~

$$\rightarrow \text{CDD}: f''(x) = \frac{f(x_{i+1}) - 2f(x_i) + f(x_{i-1})}{(\Delta x)^2}$$

*) Discrete functions.

→ Polynomial: $v(t) = a_0 + a_1 t + a_2 t^2 + a_3 t^3$ [3rd order polynomial]

Lecture 8:

*) Lagrang polynomial:

$$\rightarrow f_2'(x) = \frac{\{2x-(x_1+x_2)\}f(x_0)}{(x_0-x_1)(x_0-x_2)} + \frac{\{2x-(x_0+x_2)\}f(x_1)}{(x_1-x_0)(x_1-x_2)} + \frac{\{2x-(x_0+x_1)\}f(x_2)}{(x_2-x_0)(x_2-x_1)}$$

$$\rightarrow f''(x) = \frac{2f(x_0)}{(x_0-x_1)(x_0-x_2)} + \frac{2f(x_1)}{(x_1-x_0)(x_1-x_2)} + \frac{2f(x_2)}{(x_2-x_0)(x_2-x_1)}$$

Lecture 9:

*) Bisection method

*) Drawbacks

Lecture 10:

*) Newton's Raphson

$$\rightarrow x_{i+1} = x_i - \frac{f(x_i)}{f'(x_i)}$$

$$|\varepsilon_a| = \left|\frac{x_{i+1}-x_i}{x_{i+1}}\right| \times 100\%$$

*) Drawbacks

Lecture 11:

*) secant method: $x_{i+1} = x_i - \frac{f(x_i)(x_i - x_{i-1})}{f(x_i) - f(x_{i-1})}$

→ $|\varepsilon_a| = \left|\frac{x_{i+1}-x_i}{x_{i+1}}\right| \times 100\%$

→ Drawbacks

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