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Lec.1 Numerical Analysis

branch of Applied Mathematics.

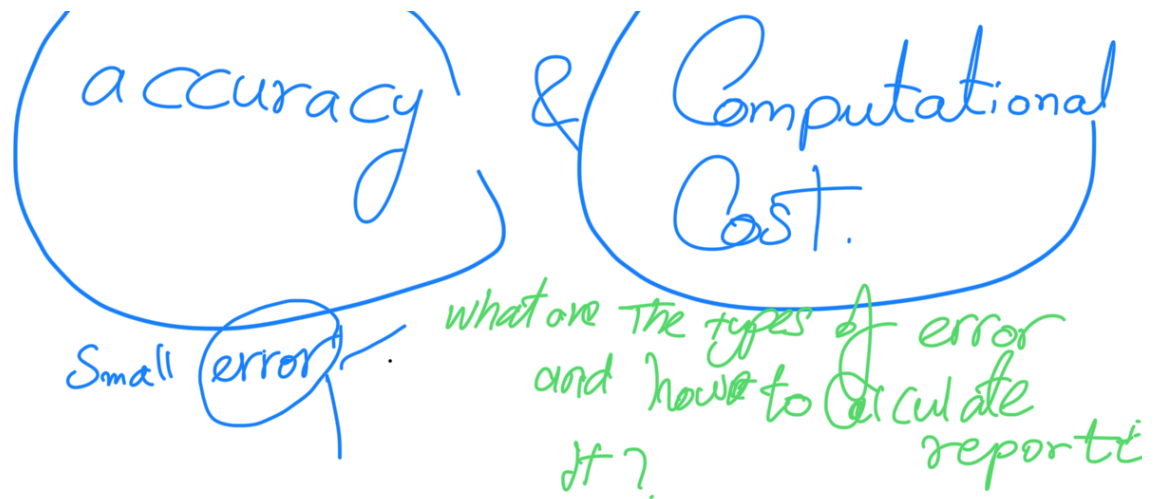
methods & algorithms
to find a solution to approximation solution
various mathematical problems.

Numerical methods.

is algorithm consist of
finite no. of steps.

That yields an approximation
solution.

Key Criteria That assess. The method are



Area of study.

- ① Interpolation, extrapolation.
 - ② Solving equation in one variable
 - ③ optimization
for example
if it's required to get
a solution with certain error
How to calculate the
no. of iteration that
gives you this error.
 - ④ Integration Differentiation
 - ⑤ Differential equation.
- $\swarrow$
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- D N F

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Error of Numerical Results

$$\text{Error (E)} = \text{Exact Value}_T - \text{Approximated Value}_{\tilde{T}}$$

Relative error.

$$E_r = \frac{\text{Error}}{\text{Exact value}} = \frac{E}{T}$$

$$\approx \frac{E}{\tilde{T}}$$

if T is not known.

$$E \ll \tilde{T}$$

$$E_r \approx \frac{E}{\tilde{T}}$$

$$T = \tilde{T} + E$$

$$|E| \leq B$$

$$ax^2 + bx + c = 0$$

$$x_1 = \frac{-b + \sqrt{b^2 - 4ac}}{2a}$$

$$x_2 = \frac{-b - \sqrt{b^2 - 4ac}}{2a}$$

$$x_1 x_2 = \frac{c}{a}$$

Solution of Equations by Iteration

to solve the equation

$$f(x) = 0$$

what this mean ?

what is the value of x which
make the value of $f = 0$

Ex $x^2 - 3x + 2 = 0$

$$x^3 + x = 1$$

$$\sin x = 0.5x, \tan x = x$$

Polynomial
Transcendental

it also called the roots of the equation

The Bisection method.

if $f(x)$ is Continuous on $[a, b]$.

if $f(a)$ and $f(b)$ of opposite sign.
Then There exists a root

$r \in (a, b)$ for which $f(r) = 0$.

and the first approximation for this root is.

$$r_1 = \frac{b+a}{2}$$

Then we have two probabilities

$$f(r_1)f(a) < 0$$

root in $[a, r_1]$

and

$$r_2 = \frac{a+r_1}{2}$$

$$f(r_1)f(b) < 0$$

$[r_1, b]$.

and

$$r_2 = \frac{b+r_1}{2}$$

Example

Solve the following equation using bi section method.

$$5x^3 + x^2 - 2 = 0$$

$$x=0 \quad f(0) = -2$$

$$x=1 \quad f(1) = 0$$

$$r \in [0, 1]$$

$$r_1 = \frac{0+1}{2} = 0.5$$



$$f(r_i) = -ve$$



other
example

$$* x^3 + 4x^2 - 10 = 0$$

$$* x^3 - x - 1 = 0$$

* by bisection method find $\sqrt[3]{25}$

→ error

n	a	b	r_i	$f(r_i)$	
1	0 ^{+ve}	1 ^{+ve}	0.5	-ve	
2	0.5 ^{-ve}	1 ^{+ve}	0.75		
3					
4					
5					