



Ahsanullah University of Science and Technology

Department of EEE

MATLAB PROJECT REPORT

Name of project: App design project using MATLAB .

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Neumeric Differentiation

Numerical differentiation is a mathematical technique. It used to approximate the derivative of a function at a specific point using discrete data points. It's commonly used when the function's analytical derivative is difficult to obtain or when dealing with data from real-world measurements.

Three main types of methods are-

Forward Difference: Approximates the derivative using the change between a point and the point slightly ahead.

$$F'(x) = (f(x+h) - f(x)) / h$$

Backward Difference: Approximates the derivative using the change between a point and the point slightly behind.

$$F'(x) = (f(x) - f(x-h)) / h$$

Central Difference: Often more accurate, it approximates the derivative using the average of forward and backward differences.

$$F'(x) = (f(x+h) - f(x-h)) / 2h$$

These are the 2nd derivative formulas. There are also 3rd derivative formula that we used in case of finding 3rd derivative of our desire function.

Neumeric Differentiation Matlab Code

```
g = input ( 'Enter your funtion with @(x):','s' );

f = str2func (g);
h = input ( 'Enter step size:' );
d = input ( 'Derivative you want:' );
x = input ( 'At whice point:' );

if d==1

    Fd2 = (f(x+h) - f(x))/h;
    Bd2 = (f(x) - f(x-h))/h;
    Cd2 = (f(x+h) - f(x-h))/(2*h);
    Fd3 = (4*f(x+h) - f(x+2*h) - 3*f(x))/(2*h);
    Bd3 = (-4*f(x-h) + f(x-2*h) + 3*f(x))/(2*h);
    disp ('using 2 point formula')
    fprintf ('Forward: %.4f\n', Fd2)
    fprintf ('Backward: %.4f\n',Bd2)
    fprintf ('central: %.4f\n', Cd2)
    disp ('using 3 point formula')
    fprintf ('Forward: %.4f\n', Fd3)
    fprintf ('Backward: %.4f\n',Bd3)

elseif d==2

    Fd3 = (f(x+2*h) - 2*f(x+h)+f(x))/(h^2);
    Bd3 = (f(x-2*h) - 2*f(x-h)+f(x))/(h^2);
    Cd3 = (f(x+h) - 2*f(x) + f(x-h))/(h^2);
    disp ('using 3 point formula')
    fprintf ('Forward: %.4f\n', Fd3)
    fprintf ('Backward: %.4f\n',Bd3)
    fprintf ('central: %.4f\n', Cd3)

else
    disp ('Error')
end
```

We use Numerical differentiation for-

Complex Functions, Real-World Data, Numerical Analysis, Engineering and Physics, Optimization, Signal Processing, Control Systems, Experimental Design, Numerical Simulations, Educational Purposes etc.