KU KONKUK UNIVERSITY

Numerical Analysis

Curve Fitting Technique: Homework

Curve-fitting Technique : Functions for Homework

Various Functions for Homework

Function#1 $f_1(x) = \sin 2\pi x, \quad x \in [0, 2]$

Function#2 $f_2(x) = \begin{cases} 3x - x^3 & \text{if } |x| \le 1 \\ 0 & \text{otherwise} \end{cases}$ over $x \in [-3,3]$

Function#3 $f_3(x) = \begin{cases} -1 & \text{if } x \le 0 \\ 0 & \text{otherwise} \end{cases}$ over $x \in [-3,3]$

Function#4 $f_4(x) = \dfrac{1}{1+x^2}$ over $x \in [-5,5]$

Remark: 2제곱 square, 3차 cubic (3차의), 4제곱 quartic (4차의),
- quadratic (2차), -cubic (3차), -quartic (4차), -quintic (5차) , 6차 -
sextic, hexic, -7차 septic, heptic, - 8차 octic, -9차 nonic, 10차 – decic

Curve-fitting Technique : Problems for Homework (1/2)

Homework can be performed based on the Matlab programs distributed.
And, Please refer to the following definitions $y = f(x;\mathbf{a}) = a_0 + a_1 x + a_2 x^2 + \cdots + a_n x^n$

Norder : Order of Polynomial
N : Number of data for Regression (100% =Training 80% + Validation Data 20%)
alpa : Noise amplitude level in the data for Regression

Nd : Number of data for Interpolation
Nv : Number of data for Validation of the Interpolation Function

(1) For Function#1, Perform the following Analyses
- **(1-1) Least square regression analysis with N=100, alpa = 0.0 with various values of Norder.**
- **(1-2) Least square regression analysis with N=100, alpa = 0.25 with various values of Norder.**
- **(1-3) Newton Polynomial Interpolation with Nv=201 with various values of Nd.**
- **(1-4) Cubic Spline Interpolation with Nv=201 with various values of Nd.**

(2) For Function#2, Perform the following Analyses
- **(2-1) Least square regression analysis with N=100, alpa = 0.0 with various values of Norder.**
- **(2-2) Lagrange Polynomial Interpolation with Nv=201 with various values of Nd.**
- **(2-3) Cubic Spline Interpolation with Nv=201 with various values of Nd.**
  - **results for the interpolated function values and comparison with the associated exact values**
  - **results for the interpolated first derivatives and comparison with the associated exact values**

Curve-fitting Technique : Problems for Homework (2/2)

(3) For Function#3, Perform the following Analyses

(3-1) Lagrange Polynomial Interpolation with Nv=201 with various values of Nd.

(3-2) Cubic Spline Interpolation with Nv=201 with various values of Nd.

(3-3) Discuss on the Runge Phenomena

(4) For Function#4, Perform the following Analyses

(4-1) Least square regression analysis with N=100, alpa = 0.0 with various values of Norder.

(4-2) Lagrange Polynomial Interpolation with Nv=201 with various values of Nd.

(4-3) Cubic Spline Interpolation with Nv=201 with various values of Nd.

End of Homework