CHAPTER FIVE

Curve Fitting

Objectives

- Power Fit

Power Fit $y = Ax^M$

$f(x) = Ax^M$, where M is known constant

- Find least-square power curve best fit (Minimize error)

$$E(x) = \sum_{k=1}^{N} (Ax_k^M - y_k)^2$$

$$\frac{\partial E(A)}{\partial A} = 2\sum_{k=1}^{N} \left(Ax_k^M - y_k\right)^1 \left(x_k^M\right) = 0$$

$$\left(\sum_{k=1}^{N} x_k^{2M}\right)A - \sum_{k=1}^{N} x_k^M y_k = 0$$

$$\boxed{A = \frac{\sum_{k=1}^{N} x_k^M y_k}{\sum_{k=1}^{N} x_k^{2M}}}$$

Power Fit $y = Ax^M$ - Example

- Find least-square power curve $y = Ax^2$ for the data points: $(0.2, 0.196)$ $(0.4, 0.785)$ $(0.6, 1.7665)$ $(0.8, 3.1405)$ $(1.0, 4.9075)$, $N = 5$

$$A = \frac{\sum_{k=1}^{N} x_k^2 y_k}{\sum_{k=1}^{N} x_k^4}$$

- From Table 5.3
- $\sum_{k=1}^{N} x_k^2 y_k = 7.68680$
- $\sum_{k=1}^{N} x_k^4 = 1.5664$
- $A = \frac{7.68680}{1.5664} = 4.9073$
- $\boxed{y = 4.9073x^2}$

Table 5.3 Obtaining the Coefficient for a Power Fit

Time, t_k	Distance, d_k	$d_k t_k^2$	t_k^4
0.200	0.1960	0.00784	0.0016
0.400	0.7850	0.12560	0.0256
0.600	1.7665	0.63594	0.1296
0.800	3.1405	2.00992	0.4096
1.000	4.9075	4.90750	1.0000
		7.68680	1.5664

[1]

Note: d is y and t is x

References

- [1] Mathews J. H. and Fink K. D. (1999). Numerical Methods using MATLAB, NJ: Prentice Hall

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