EML3041 Computational Methods

Fall 2023

Week 10: Oct 23 - Oct 27

Answer the free-response questions on a fresh sheet of paper. *Solve the problem as if you were submitting them for a test.* Identify each part separately. Submit #1.

1. a) Show the full derivation of finding the general formula for regressing *n* data points $(x_1, y_1), (x_2, y_2), \dots, (x_n, y_n)$ to $y = kx^2$.

b) Did you forget to do the second derivative test and establish that the answer in part (a) in fact corresponds to a local minimum of the sum of square of residuals? If you did not, conduct the test now as you should have done this in part (a). Is this local minimum also the absolute minimum? If so, how do you reason that out?

c) The following force vs. displacement data is given for a nonlinear spring

Displacement, x(m) 10 15 20 Force, F(m) 100 200 400

Estimate the value of k if $F = kx^2$ is the regression model.

Answer: (a) $k = \frac{\sum_{i=1}^{n} y_i x_i^2}{\sum_{i=1}^{n} x_i^4}$ (b) Not given intentionally (c) 0.9745 N/m^2