
MATH 588

Introduction to FEM

Homework assignment 3

Date assigned: March 9, 2025

Due date: March 24 , 2025

Problem 1

Consider a one-dimensional problem with a Neumann boundary condition at $x = 1$:

$$\begin{aligned}-\frac{d^2p}{dx^2} &= f(x), \quad 0 < x < 1 \\ p(0) &= \frac{dp}{dx}(1) = 0\end{aligned}$$

Express this problem in a Galerkin variational formulation, formulate the finite element method using piecewise linear functions, and determine the corresponding linear system of algebraic equations for a uniform partition.

Problem 2

Carry out the derivation of the following basis function from the *Global coordinate approach* lecture:

$$\varphi_i(x) = \frac{x - x_{i-1/2}}{h_i} \left(\frac{2}{h_i} (x - x_{i-1/2}) + 1 \right), \quad x \in [x_{i-1}, x_i].$$

Submission

Submit your work as a PDF with handwritten or typed solutions.