EG3111 Finite Element Analysis and Design

Exercise sheet #1: Weighted residual method

Question

Use Galerkin's method to find approximate solutions to

$$\frac{du}{dx} + u = 0$$

over the range $0 \leq x \leq 1$ subject to $u(0) = 1$ given the following shape functions:

(a) *A single quadratic shape function*

Assume

$$\tilde{u}(x) = 1 + c_1 x + c_2 x^2$$

where c_1 and c_2 are the two degrees of freedom (DOF) to be determined.

(b) *A piecewise linear shape function*

$$\tilde{u}(x) = \begin{cases} 1 + 2(u_1 - 1)x & for\ 0 \leq x \leq \frac{1}{2} \\ (2u_1 - u_2) + 2(u_2 - u_1)x & for\ \frac{1}{2} \leq x \leq 1 \end{cases}$$

where u_1 and u_2 are the two DOF to be determined.