Math596 HW1 (Spring 2020)

Professor Youngjoon Hong — Due Date: Feb. 20 (12:30 pm)

Problem 1 *(Programming exercise). Consider the 1D BVP*

$$\begin{aligned} -u'' + 3u' &= e^x \quad in \quad (0,1), \\ u(0) &= 0, \\ u'(1) &= 3. \end{aligned}$$

Use the linear finite element method to find the numerical solution of u.

Problem 2 *(Programming exercise). Use the linear finite element method with* $elm = 50$ *to find the numerical solutions of the 1D BVP*

$$\begin{aligned} -\varepsilon u'' + u &= 1 \quad in \quad (0,1), \\ u(0) &= 0, \\ u(1) &= 0, \end{aligned}$$

where $\varepsilon = 10^{-1}, 10^{-2}$, *and* 10^{-3}, *respectively. Here elm denotes the number of elements.*

Problem 3 *(Programming exercise). Consider the 1D BVP*

$$\begin{aligned} -u'' &= f \quad in \quad (0,1), \\ u(0) &= 0, \\ u'(1) &= 3, \end{aligned}$$

where $f(x) = x$. Use the quadratic finite element method with $elm = 7$ to find the numerical solution of u. Here elm denotes the number of elements.