

269C, Spring 2004, Vese

**First project: Due on Friday, May 14**

Show that the problem

$$\begin{cases} -u''(x) + u(x) = f(x), & 0 < x < 1, \\ u(0) = 0, u'(1) = 0 \end{cases}$$

can be given a weak variational formulation.

Formulate a FEM for this problem using piecewise-linear functions. Determine the corresponding linear system of equations in the case of a uniform partition and study in particular how the boundary condition  $u'(1) = 0$  is approximated by the method.

Write a computer program for the piecewise-linear FEM applied to this problem. Present calculations with  $h = 0.1$  and  $h = 0.2$ , for  $f(x) = 2 + 2x - x^2$ . Approximate  $\int f(x)\varphi_j(x)dx$  by the midpoint rule. (the exact solution is  $u(x) = x(2 - x)$ ).

(see also section 1.8: Remarks on programming)