0.1 Task 1

The domain $[0,1] \times [0,1]$ is divided into elements by splitting each cell of a uniform Cartesian grid from the top left to the bottom right corner to make triangles.

The reference element $\tilde{K}$ is a right triangle with the right corner in $(0,0)$ and the other corners in $(0,1)$ and $(1,0)$ respectively. All affine functions over the element can be constructed from linear combinations of the three basis functions

$$\tilde{\phi}_1(x,y) = 1 - x - y \tag{1}$$

$$\tilde{\phi}_2(x,y) = x \tag{2}$$

$$\tilde{\phi}_3(x,y) = y \tag{3}$$

where each of the basis functions is nonzero in only one of the element‘s corners.

On the reference element we have

$$\tilde{a_{ij}} = \int_{\tilde{K}} \nabla\tilde{\phi}_i \cdot \nabla\tilde{\phi}_j dx \tag{4}$$

$$\tilde{m_{ij}} = \int_{\tilde{K}} \tilde{\phi}_i\tilde{\phi}_j dx \tag{5}$$

$$\tag{6}$$

On the basis element, t

By

Continuous piece-wise affine functions on the whole domain are spanned by the