

Consider the heat conduction problem

$$\begin{cases} u_t = u_{xx} + u_{yy}, (x, y) \in \Omega, t > 0. \\ u(x, y, 0) = f(x, y), (x, y) \in \Omega, \\ u(x, y, t) = 0, (x, y) \in \partial\Omega, t > 0, \end{cases}$$

where a triangular element mesh is chosen as shown in the figure below. Use the formulas

$$m_{ij} = \iint_{\Omega} \varphi_i \varphi_j \, dx \, dy \quad \text{and} \quad d_i = \frac{1}{3} \sum_{\mu} S_{\mu}, \quad i=1, 2, 3, 4, 5$$

to find M and D . Here, $\varphi_i(x, y) = L_i^u$ on Δ_{μ} and zero elsewhere.

