

## Computer Assignment #3. Due November 15, 2018

Consider the following 2-dimensional boundary value problem in Fig. 1:

$$u_{,xx} + u_{,yy} = (x^2 + y^2)e^{xy} \quad \text{in } \Omega$$

$$u = y^2 \quad \text{on } \Gamma^1$$

$$u = x^2 \quad \text{on } \Gamma^2$$

$$u_{,n} = ye^y \quad \text{on } \Gamma^3$$

$$u_{,n} = xe^x \quad \text{on } \Gamma^4$$

Hand derivation

- (1) Formulate weak form of this problem.
- (2) Consider a uniform discretization using four bi-linear elements as shown in Fig. 2. Derive the element stiffness matrix and force vector for element No. 1 (express them in the integral form to be used for problem (3), and no need to work out the analytical integration).

Computer coding

- (3) Use 2x2 Gauss integration to integrate element stiffness matrix and force vector of element No. 1, and print out the integrated stiffness matrix in a 4x4 matrix and the force vector in a 4x1 vector.

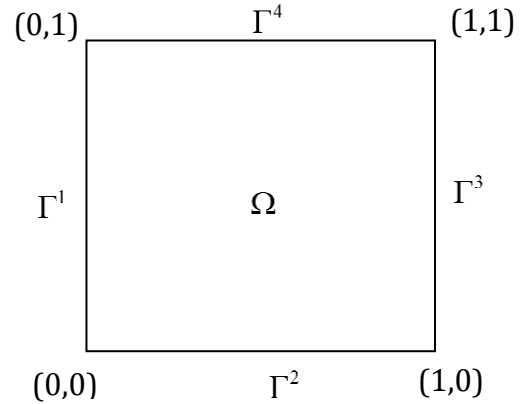


Figure 1. Problem Domain

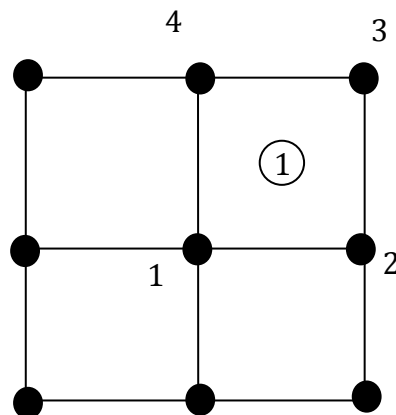


Figure 2 FE Discretization