

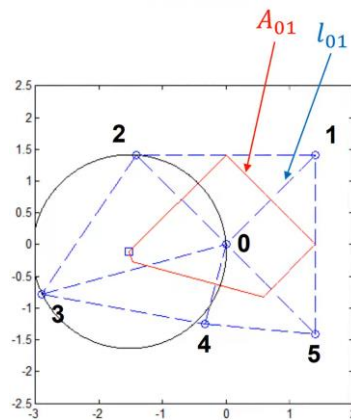
HW18

20202041 Park, Nuri

Finite Volume Method (box method)

Differential form : $\nabla \cdot F = s \rightarrow \text{Integrated form } \oint_{\partial\Omega} F \cdot da = \int_{\Omega} s d^3x$

Ω is the Voronoi cell



$$\sum_i F_{0i} A_{0i} = \sum_i \epsilon \frac{\phi_i - \phi_0}{l_{0i}} A_{0i}$$

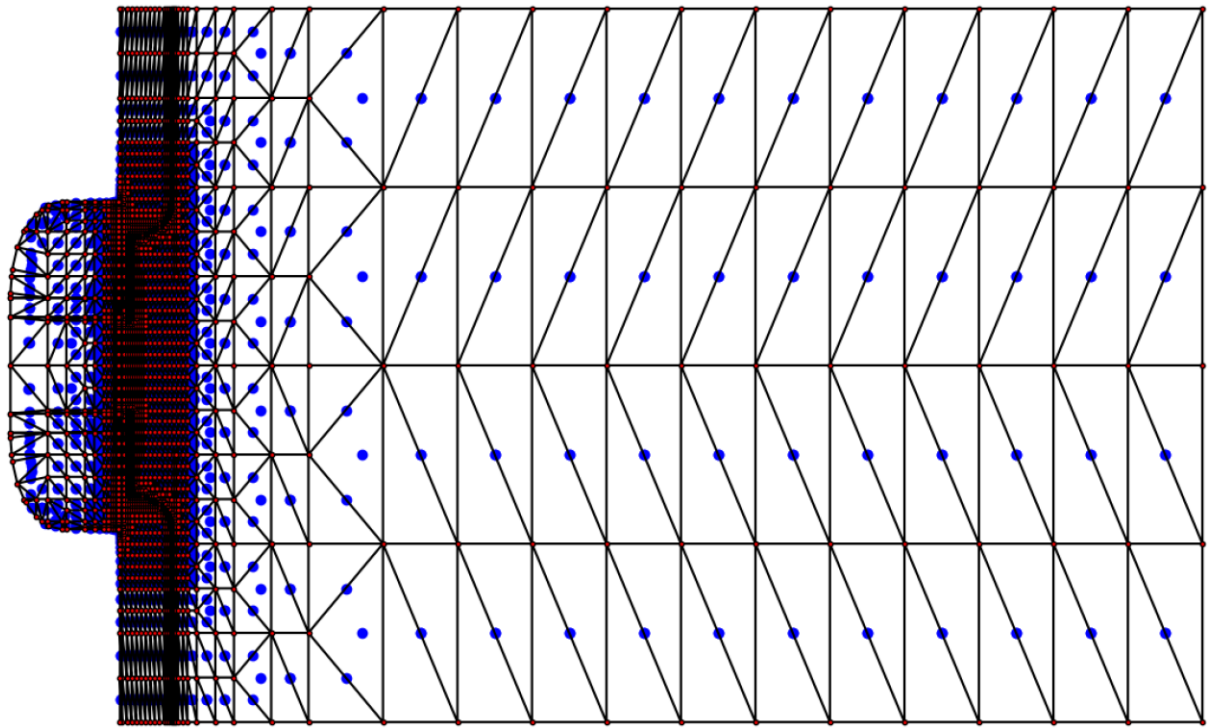
$A_{01}^2 + \left(\frac{l_{01}}{2}\right)^2 = R^2$, R is the radius of the circumcenter of the triangle.

Since we want to solve Laplace equation, we have equation

$$\sum_i C_{0i} \phi_i - \phi_0 \sum_i C_{0i} = 0, \quad \left(\frac{A_{0i}}{l_{0i}} = C_{0i}\right)$$

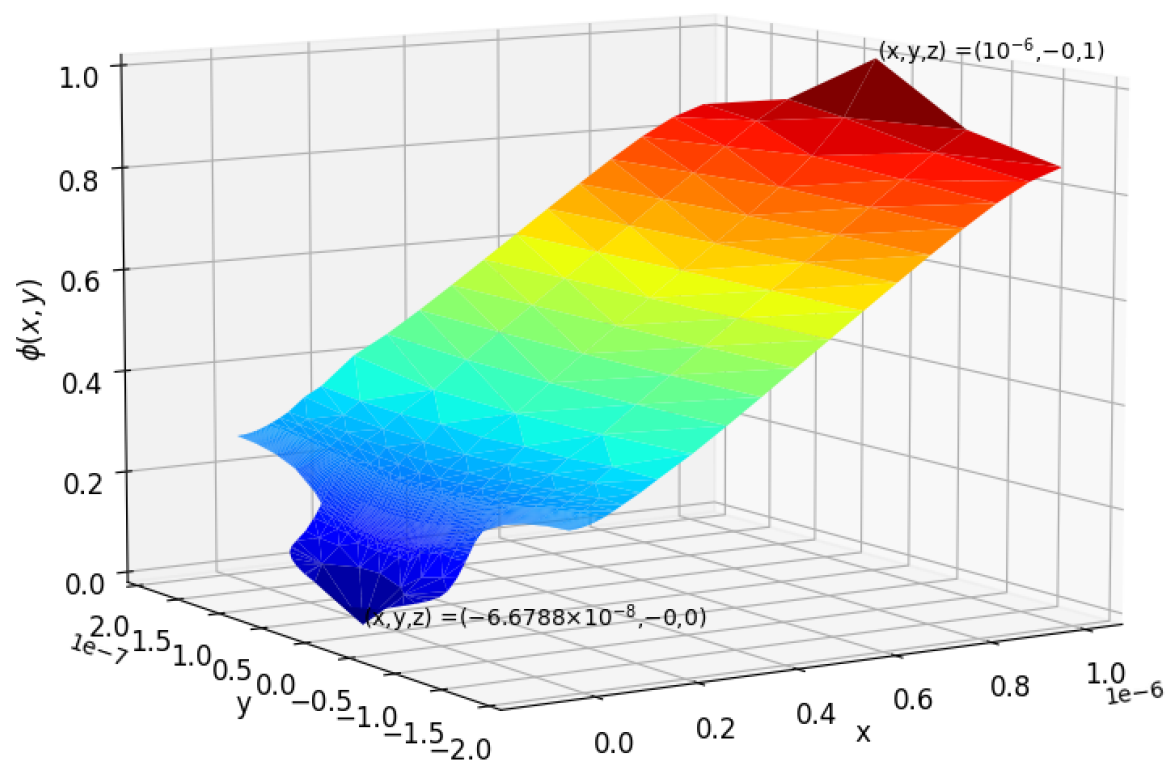
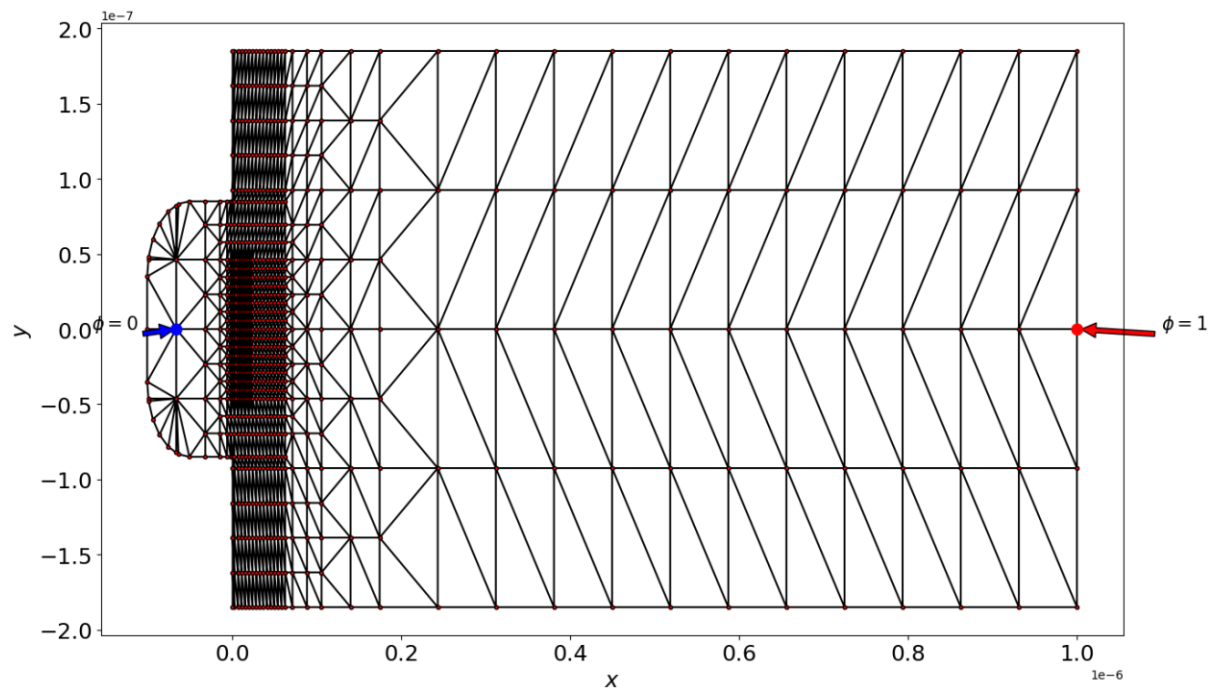
Thus the matrix we would make is,

$$\begin{pmatrix} (-C_{01} - C_{02} \dots - C_{0N}) & C_{01} & C_{02} & \dots & C_{0N} & 0 & 0 & 0 & 0 \\ \vdots & \vdots & \vdots & \vdots & \vdots & \vdots & \vdots & \vdots & \vdots \end{pmatrix} \begin{pmatrix} \phi_0 \\ \phi_1 \\ \phi_2 \\ \vdots \\ \phi_N \end{pmatrix}$$

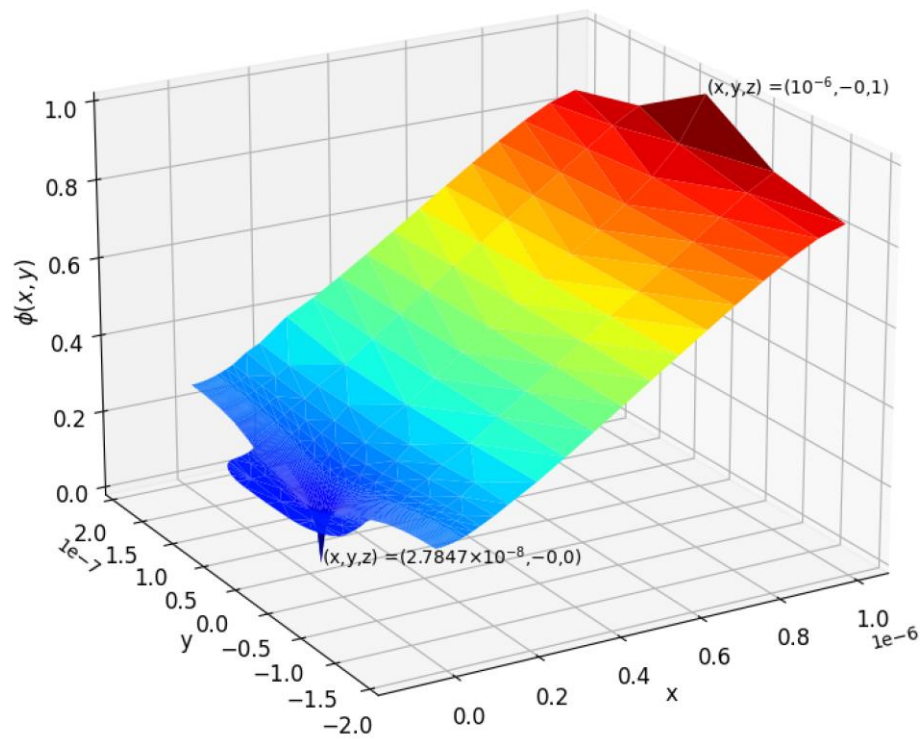
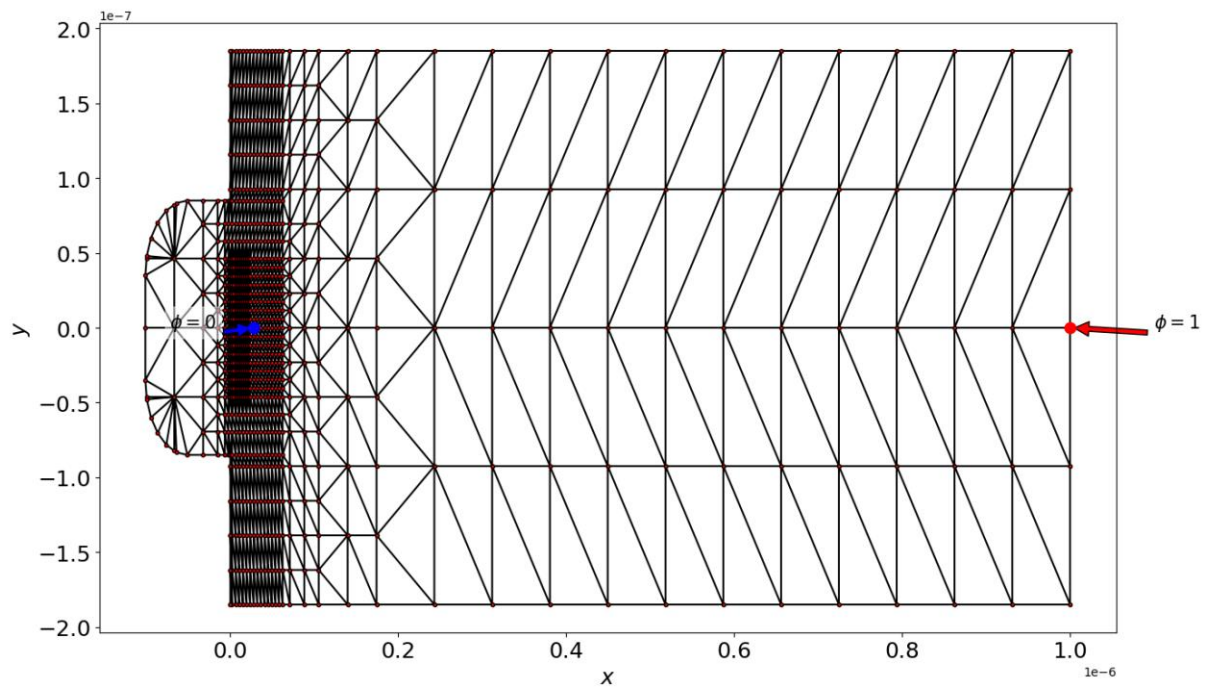


Upper figure shows triangular mesh. The blue circle is the circumcenter for each triangle.

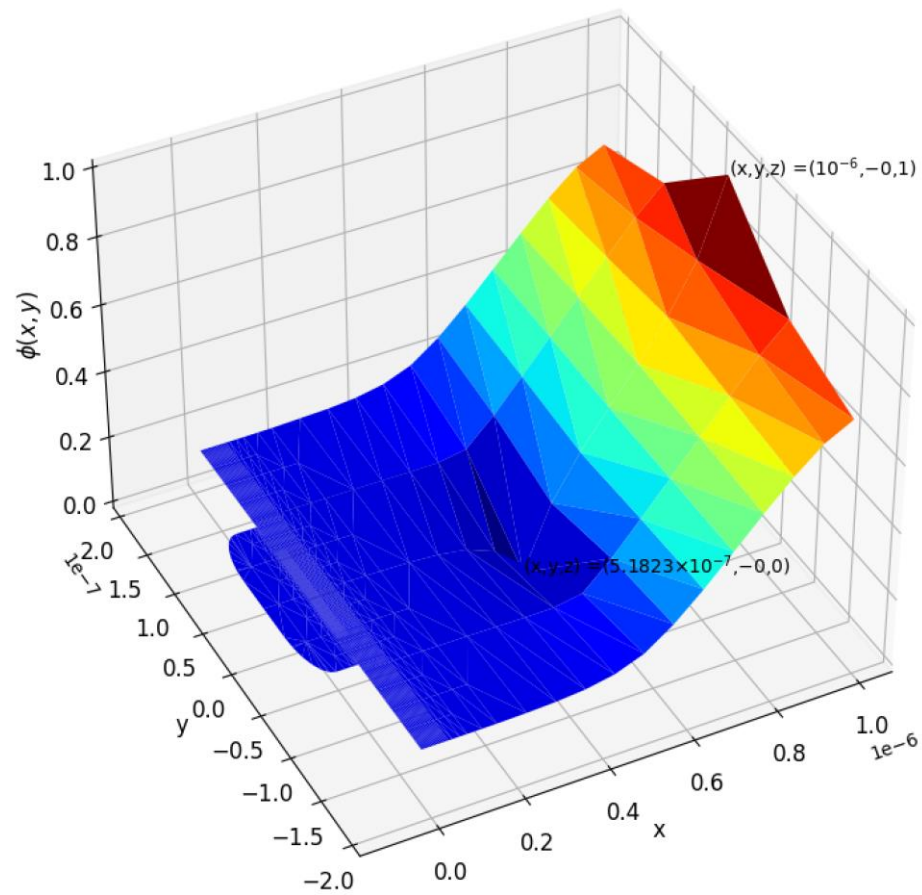
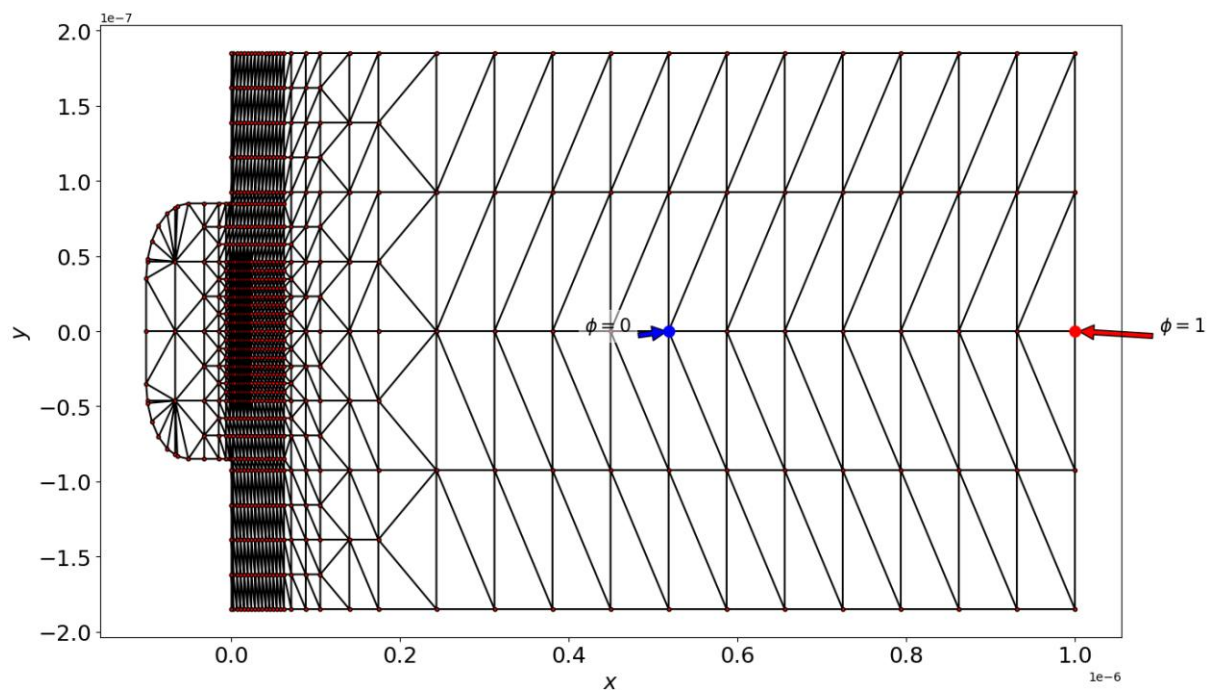
Result 1.



Result 2.



Result 3.



Result 4.

