Typical FEM discretization

- Let us work through an example to make things more clear. Consider the PDE

$$\nabla^2 \vec{u} = 0, \quad \nabla \equiv \begin{bmatrix} \partial_x \\ \partial_y \end{bmatrix}, \quad \text{and} \quad \vec{u} \in \Re^2$$

- Doing FEM gives the counter part discrete version for triangle t with nodes i,j,k as

- $$\underbrace{\begin{bmatrix} E_{ii} & E_{ij} & E_{ik} \\ E_{ji} & E_{jj} & E_{jk} \\ E_{ki} & E_{kj} & E_{kk} \end{bmatrix}}_{E_t} \begin{bmatrix} u_{x,i} \\ u_{y,i} \\ u_{x,j} \\ u_{y,j} \\ u_{x,k} \\ u_{y,k} \end{bmatrix} = \vec{0}$$

Initialize Space

- First we need to get all triangles
  - glue::Phase omega = glue::make_phase(…);
- Next we must allocate space for the discrete FEM element matrix array
  - unsigned int T = omega.m_triangles.size();
  - std::vector<util::Block3x3Tensor2> Es;
  - Es.resize(T);