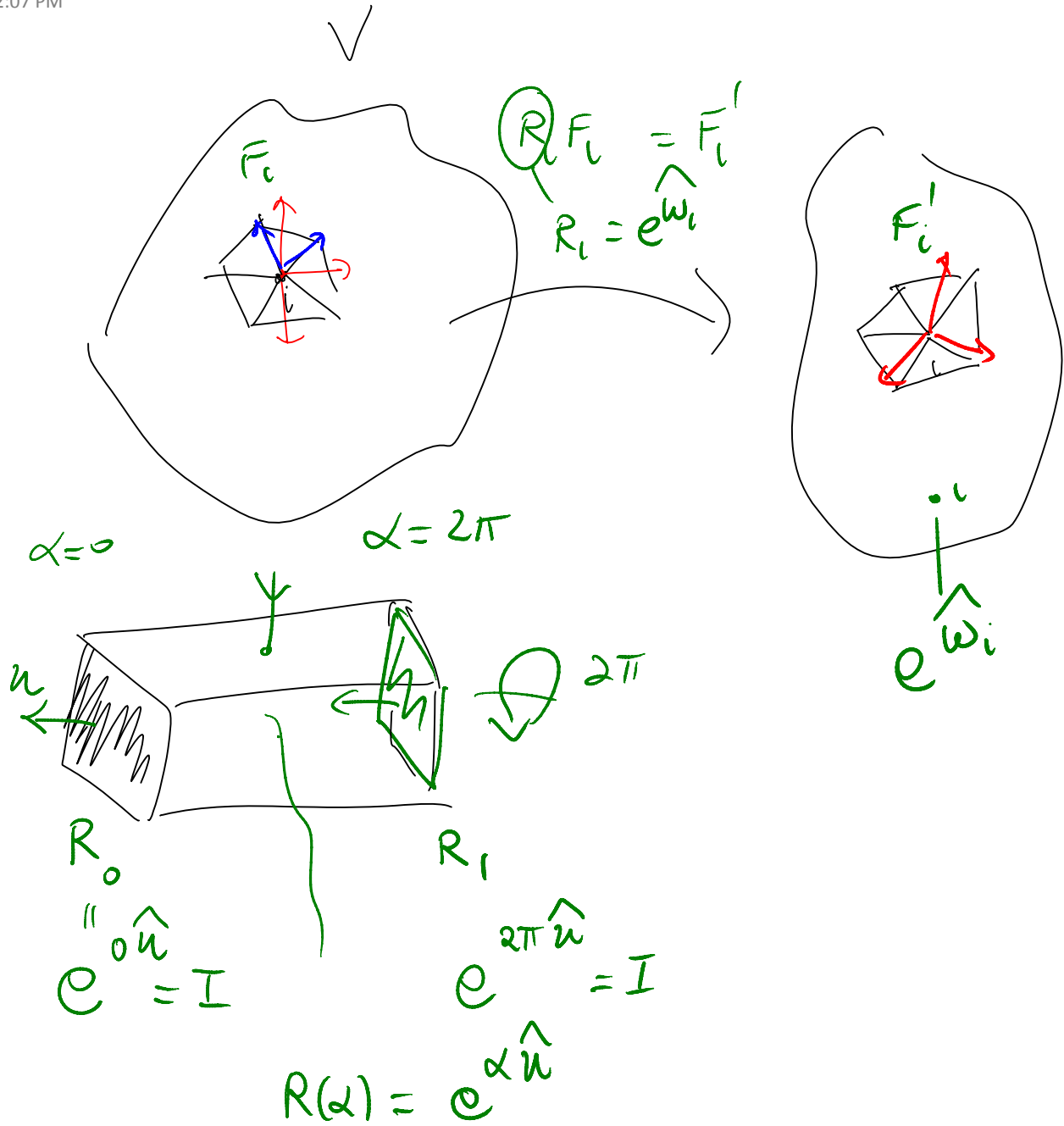


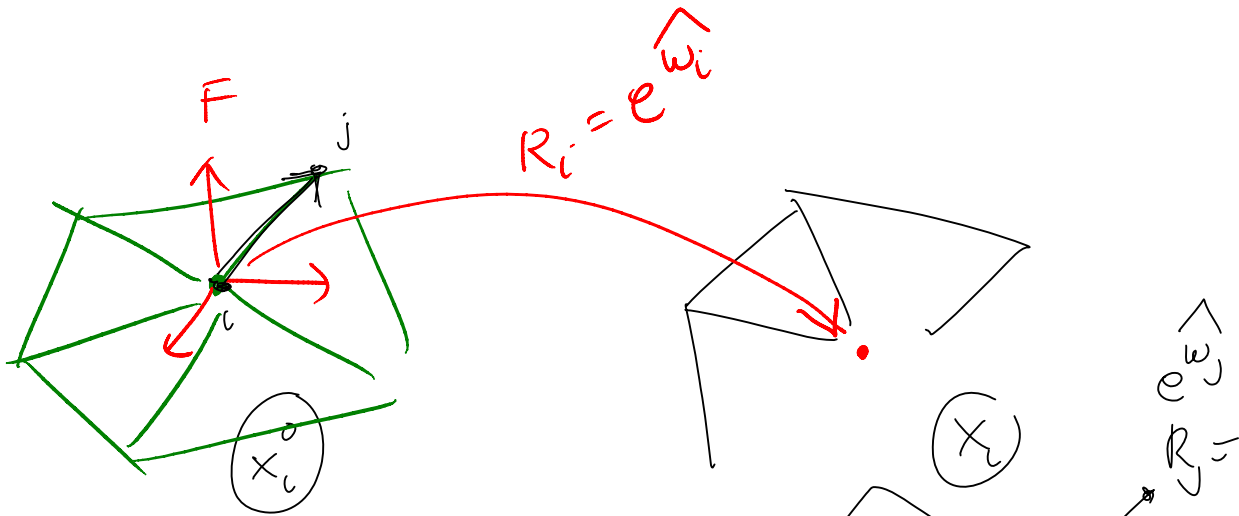
# Mesh deformations specified as fields of rotations

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# Deformation Energies

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$$E(x) = \sum_{(ij)} w_{ij} \|x_i - x_j\|^2$$

$$v_{ij} = x_i^0 - x_j^0 \leftarrow \text{before deformation}$$

$$x_i - x_j \sim R_{ij}(x_i^0 - x_j^0) = R_{ij}(v_{ij})$$

$$E(x) = \sum_{(ij)} w_{ij} \|x_i - x_j - R_{ij} v_{ij}\|^2$$

↓

$$\frac{1}{2} \frac{\partial E}{\partial x_i} = \sum_{j \in i^*} w_{ij} (x_i - x_j - R_{ij} v_{ij})$$

$$x_i + \delta x_i$$

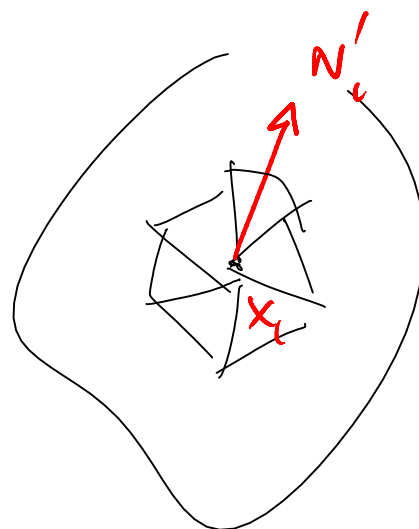
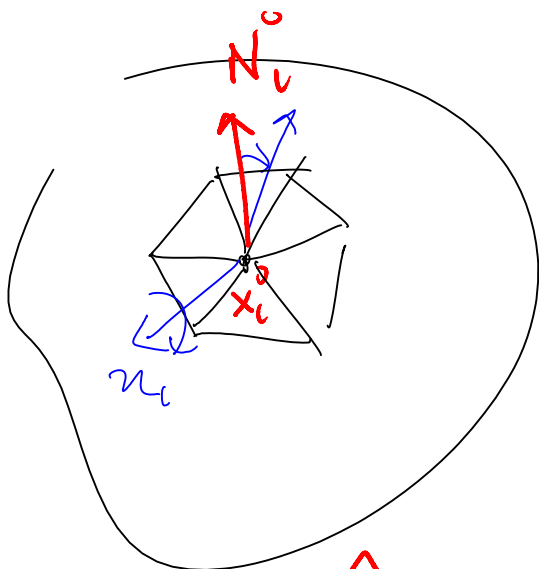
$$\left( \sum_{j \in i^*} w_{ij} \right) \delta x_i = \sum_{j \in i^*} w_{ij} (x_j - x_i) + \sum_{j \in i^*} R_{ij} v_{ij}$$

$$\underbrace{\left( \sum_{j \in I^*} w_j \right)}_{\substack{\text{sum} \\ w_i}} \delta x_i = \sum_{j \in I^*} w_j (x_j - x_i) + \sum_{j \in I^*} R_{ij} v_{ij}$$

$$\delta x_i = \underbrace{\frac{1}{w_i} \sum_{j \in I^*} w_j (x_j - x_i)}_{\Delta x_i} + \underbrace{\frac{1}{w_i} \sum_{j \in I^*} w_j R_{ij} v_{ij}}_{- (x_j^0 - x_i^0)}$$

# Rotation fields

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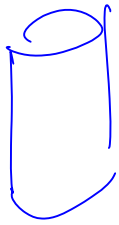
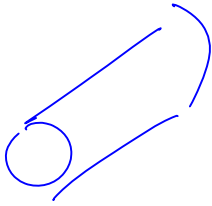
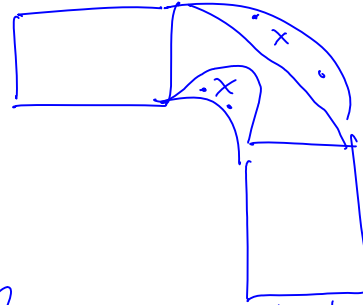
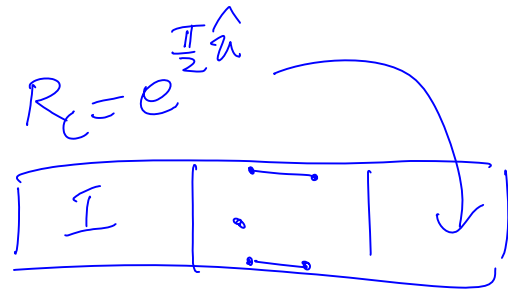
$$R_i = e^{\hat{\omega}_i}$$

$$\omega_i = \alpha_i n_i$$

$$\|n_i\| = 1$$

# Potential problems

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stretch factor

$$\sigma_{ij} > 0$$

$$E(x) = \sum_{(i,j)} w_{ij} \|x_i - x_j - R_{ij} v_{ij}\|^2$$