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Couple Stress In The Vertex Model Of Cellular Monolayers

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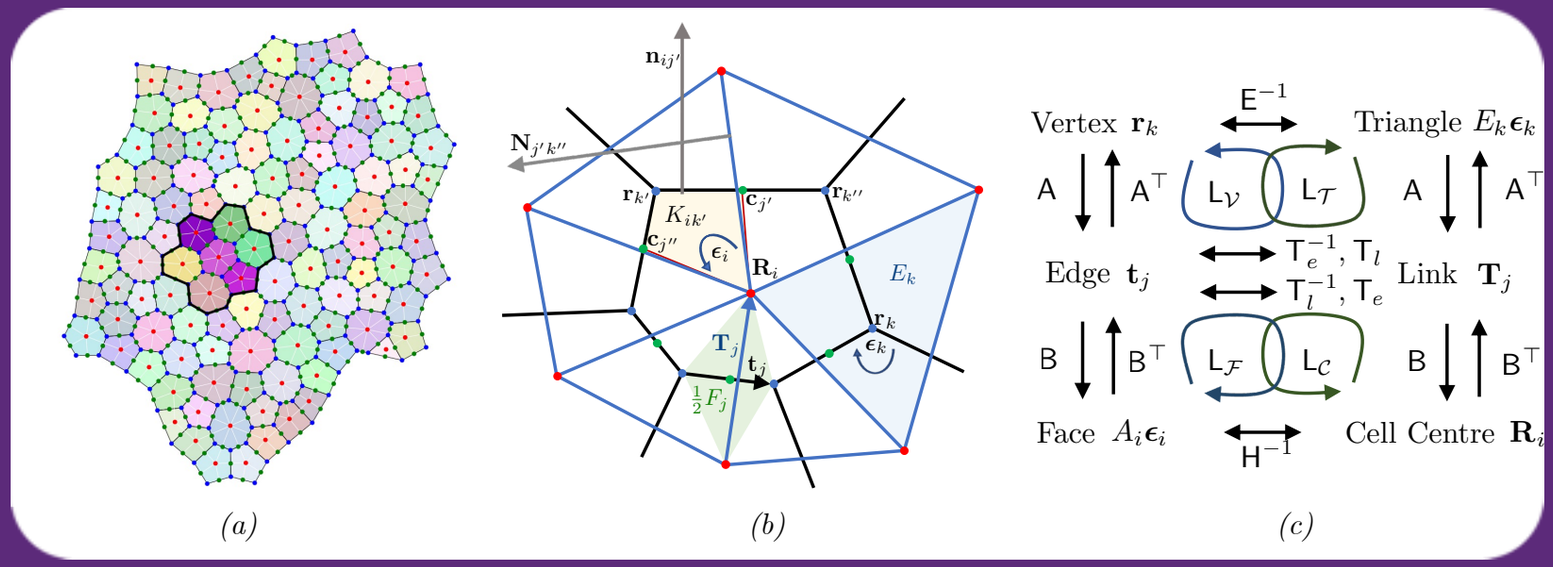
Aims

- Develop vertex model framework using incidence matrices.

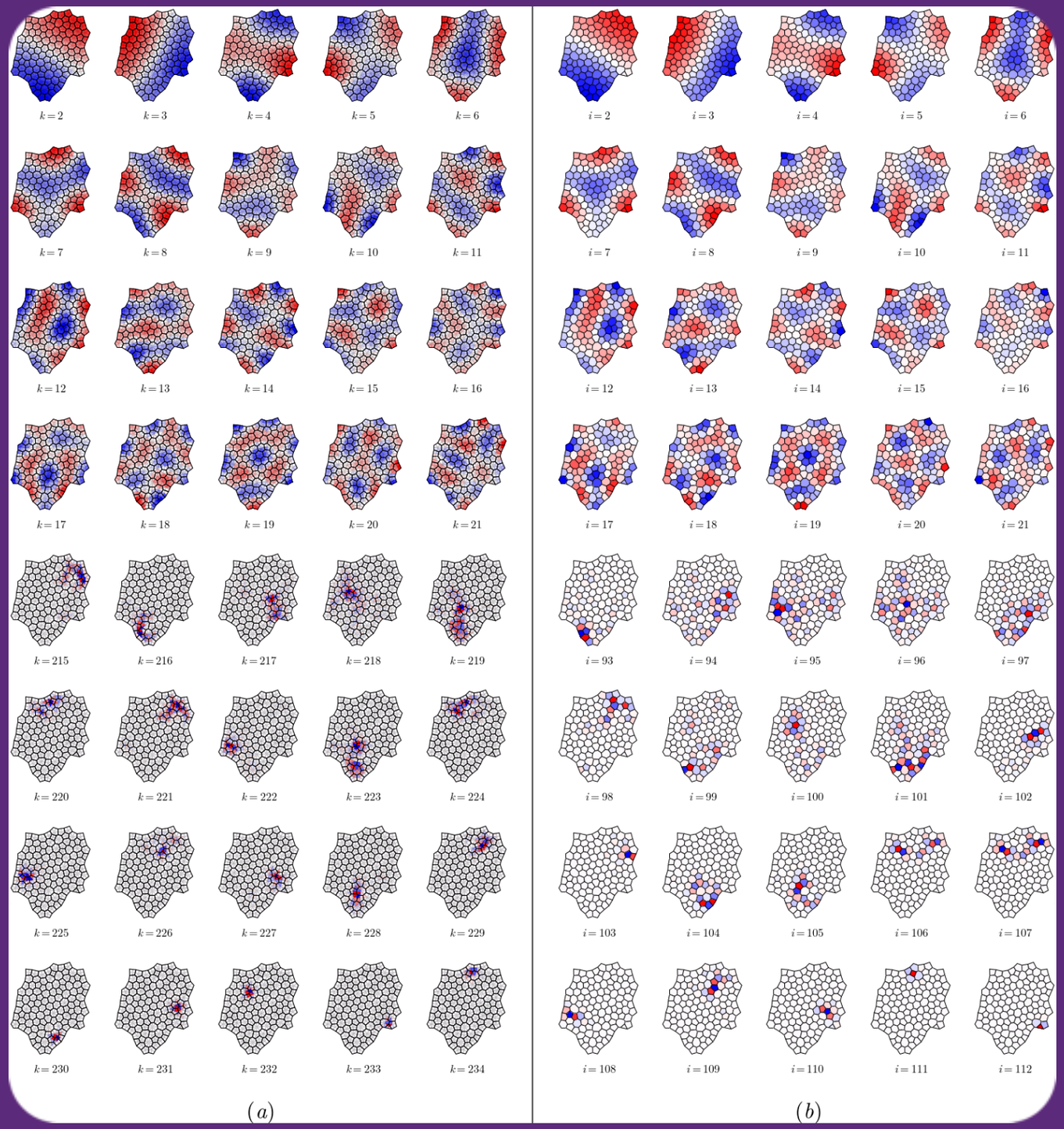


$$B = \begin{array}{c} \text{Edges} \longrightarrow \\ \text{Cells} \downarrow \end{array} \begin{pmatrix} 1 & 0 & 0 & -1 & 0 & \dots \\ 0 & 0 & 1 & 0 & -1 & \dots \\ 0 & -1 & 0 & 1 & 0 & \dots \\ 0 & 0 & -1 & 0 & 0 & \dots \\ -1 & 1 & 0 & 0 & 1 & \dots \\ \vdots & \vdots & \vdots & \vdots & \vdots & \end{pmatrix}$$

$$A = \begin{array}{c} \text{Vertices} \longrightarrow \\ \text{Edges} \downarrow \end{array} \begin{pmatrix} 1 & 0 & 0 & -1 & 0 & \dots \\ 1 & 0 & 0 & 0 & -1 & \dots \\ 0 & 1 & 0 & -1 & 0 & \dots \\ 0 & 0 & -1 & 0 & 1 & \dots \\ 1 & 0 & 0 & 0 & -1 & \dots \\ \vdots & \vdots & \vdots & \vdots & \vdots & \end{pmatrix}$$

Aims

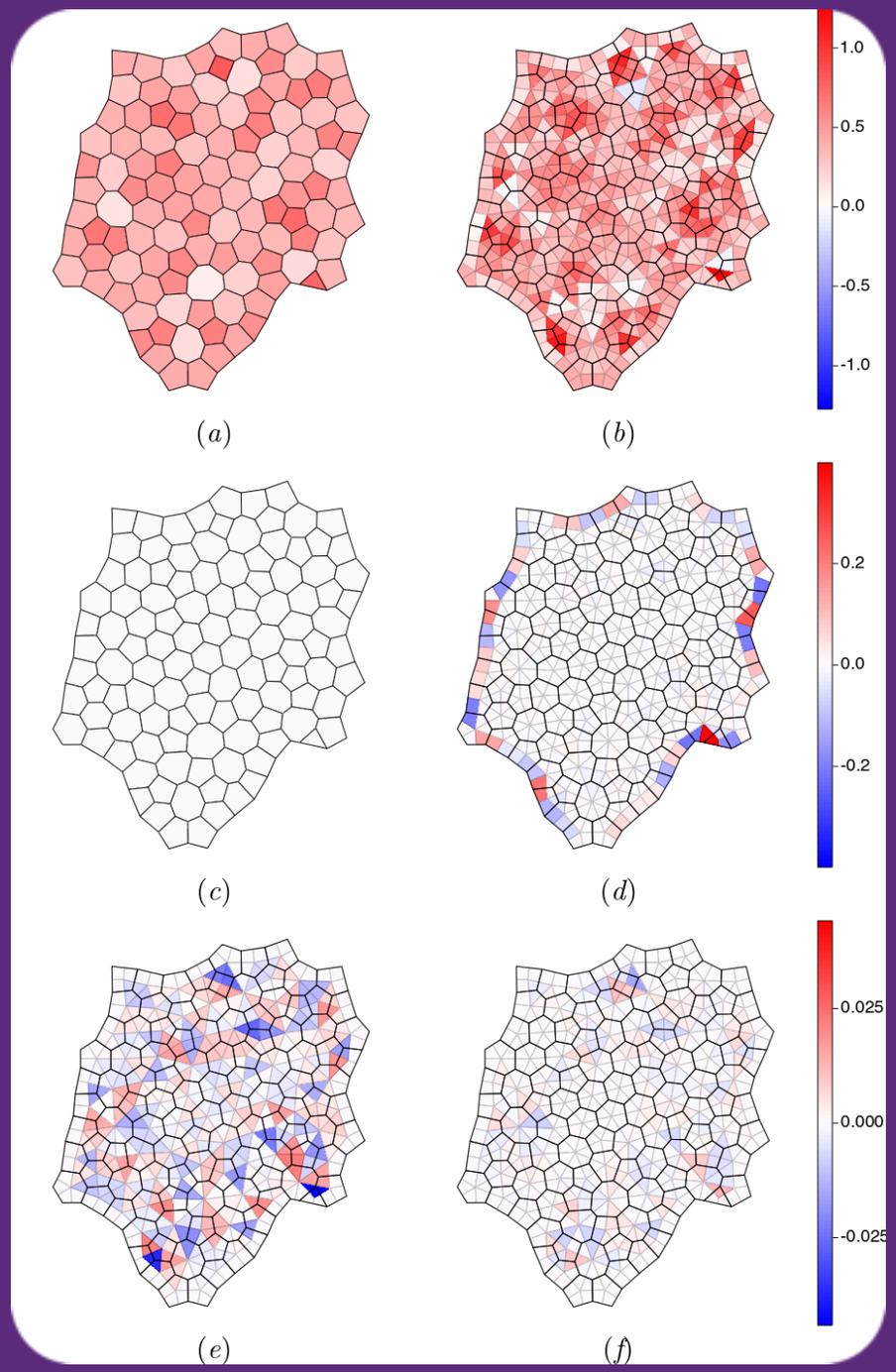
- Develop discrete calculus approach.
- Derive eigenmodes of discrete Laplacians across monolayers.



Jensen, O. E., & Revell, C. K. (2022)

Aims

- Calculate stresses across (primal) cells and (dual) triangulation, and discrete Airy and Mindlin stress potentials



Jensen, O. E., & Revell, C. K. (2022)

Aims

- Develop discrete potential theory for monolayers with disordered internal structure.