A continuum model for nonlinear lattices under large deformations

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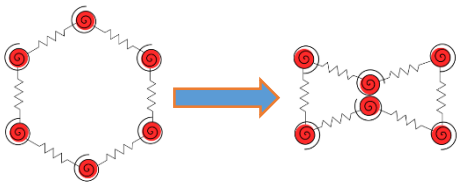
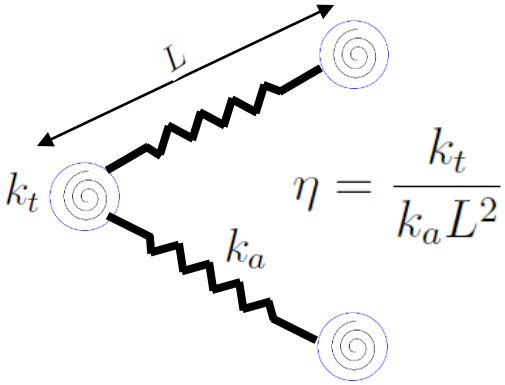
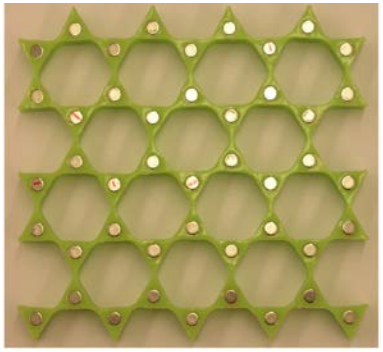
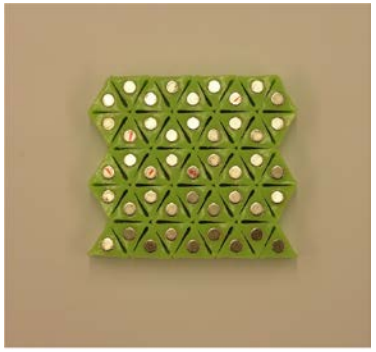
- Motivation: Develop framework to design multi-stable structures

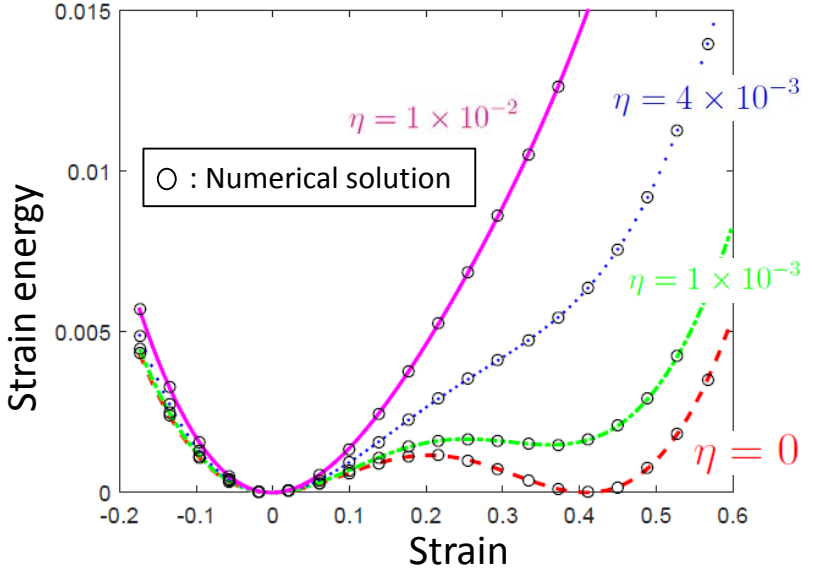






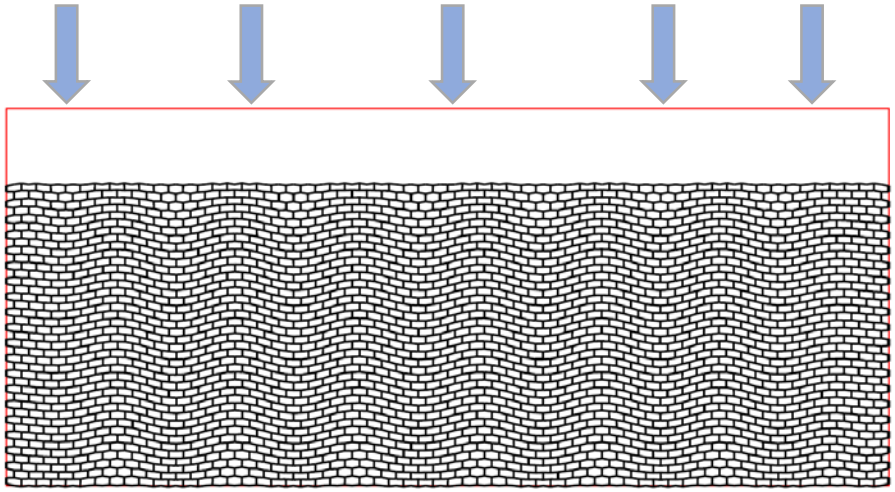


- Consider hexagonal lattice of axial and torsional springs
  - Analytical solution for unit cell potential energy under arbitrary loading
  - Potential energy is non-convex, structure bistable for low η



Discrete lattice and continuum solutions

- Pattern formation due to non-convexity



- Comparison of lattice and homogenized continuum solution for non-uniform boundary conditions
  - Lattice deformation field predicted by homogenized solution (using finite element analysis)
  - Effective force-displacement behavior also predicted accurately