

Project Description

- PXCM is a cellular structure that exhibits multiple stable states similar to phase transformations observed in shape memory alloys.
- It is made up of bistable or metastable beams and has shown to exhibit hysteretic behavior.
- Here we investigate it's potential as an energy harvesting material.

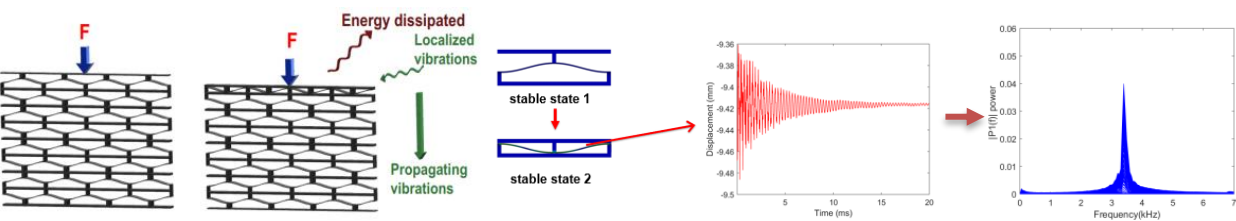
Discussion

- As the material changes state and reaches the subsequent stable state the induced vibrations are around the resonant frequency in that state.
- Optimally designed piezoelectric elements can be embedded to harvest the vibrational energy.

Approach - FEA

- Conduct dynamic explicit analysis in ABAQUS.
- Model the structure in the plane strain approximation.
- Observe vibrations after a unit cell reaches second stable state.
- Identify dominant frequency and design piezoelectric elements.

Results



- The conversion of quasistatic or low frequency input to high frequency oscillations can be leveraged to harvest energy.
- PXCM can be made into multifunctional material that can both absorb energy as well as harvest energy.
- Civil infrastructure like bridges or automobile frames can be made up of PXCM that can power condition monitoring sensors or low power electronics.

PXCM can be used to convert low frequency input to high frequency oscillations and harvest energy by embedding piezoelectric elements.