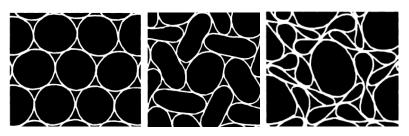# Design of switchable many-state architectured materials through the exploitation of nonlinear post-buckling behavior

Ariel Ibarra Pino

Fifth deal.II Users and Developers Workshop

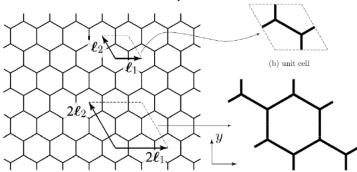Texas A&M University, College Station, TX, USA;   August 3-7, 2015

Honeycombs as switchable materials

Experimental characterization

Papka and S. Kyriakides. Biaxial crushing of honeycombs part I: Experiments. IJSS, 1999.
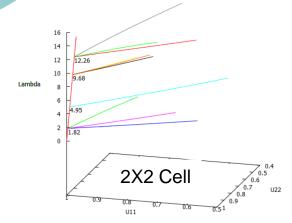
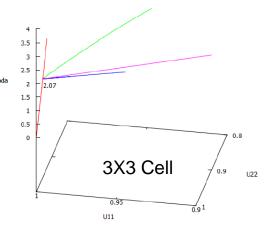## Theoretical and computational studies

Saiki et. Al. Flower like patterns appearing on a honeycomb structure and their bifurcation mechanism. IJ of Bifurcation and Chaos (2002).

Other studies followed: Healey (1994), Triantafyllidis (1998), Ohno (2001)

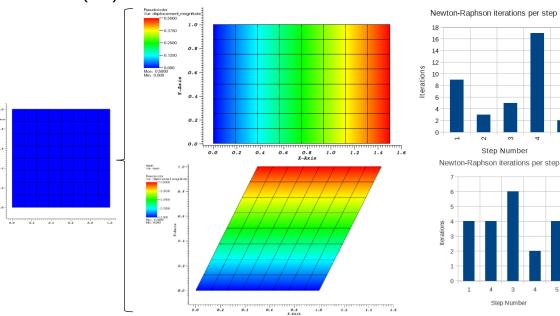## (Our) current work

2X2 Cell

3X3 Cell

I need your help!

TOY PROBLEM (for this week)

Implementation of a Saint Venant-Kirchhoff (nonlinear) constitutive law with uniform loads. Square domain (2D) and N-R solver.

It seems to be working (max. discrepancy w.r.t. theoretical result $\sim 10^{-15}$ or less. But…

-It may not be efficient.
-I need the full (global) stiffness matrix for the branch following bifur-cation analysis to work.
- I want to use a rhomboidal domain.

How I may be able to help (beginners)

COMPUTER RUNNING ON WINDOWS, HOW I MADE deal ii TO WORK?
        - Cheating! I Installed VirtualBox, Ubuntu OS and deal ii there.

IMPLEMENTATION OF SOME NONLINEAR CONSTITUTIVE LAWS FOR SOLIDS.
        - Implementing a Saint Venant – Kirchhoff model w/o using declaration of parameters as done in Step 44. This example may be an easy to follow introduction to more complicated (time or history dependent) constitutive models.