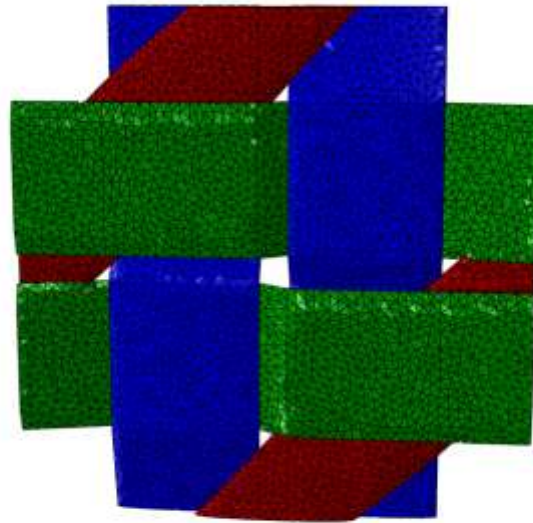


# Triaxial Braid Composite Modeling



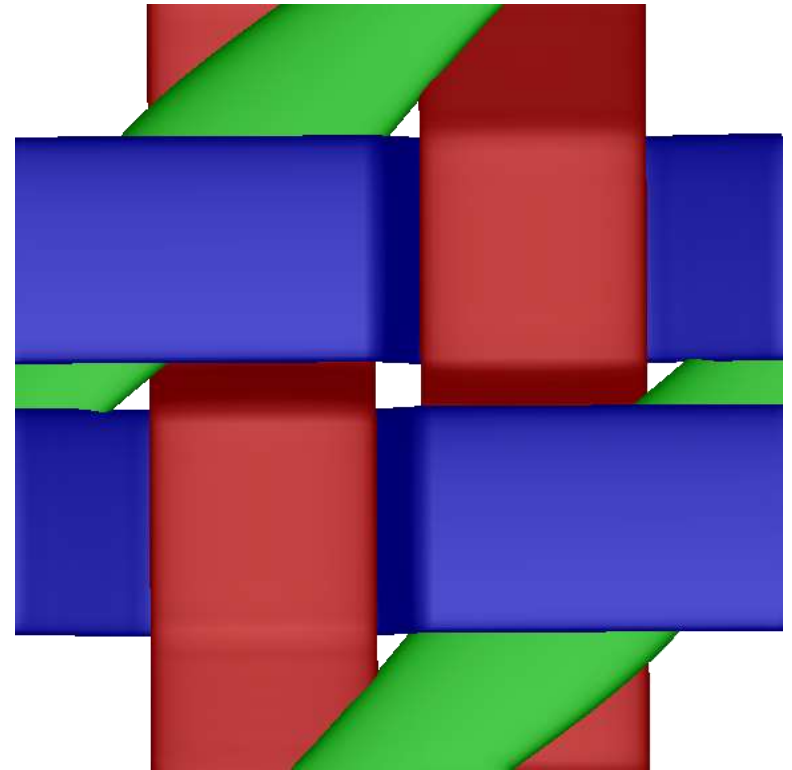
Presented by: Luke Walker

Funded by: Wyoming NASA Space Grant



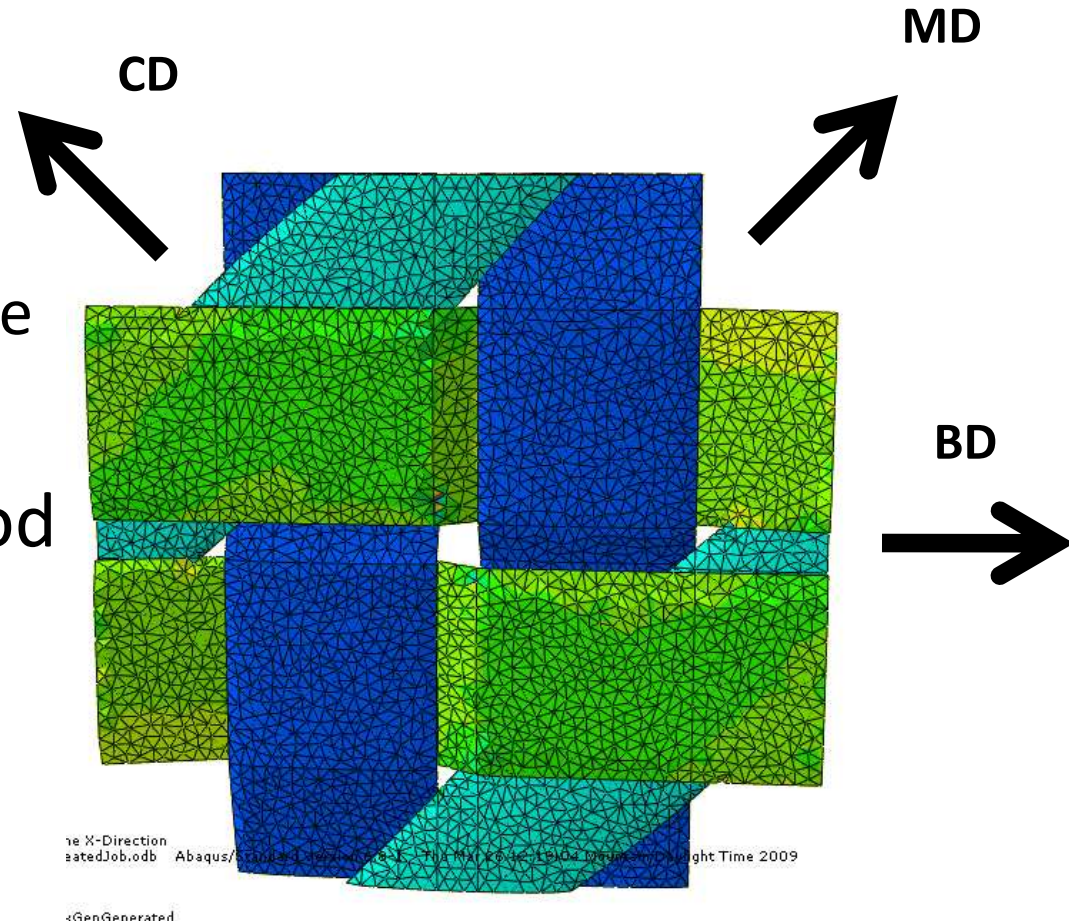
# Overview

- Project Introduction
  - Finite Element Method
- Background Information
  - Materials
  - Experimental Research
- Methods
- Results
- Conclusions



# Project Introduction

- Composites
  - Strength to stiffness
  - Materials of the future
- Finite Element Method
- Tri-axial Braid
  - Needs Characterized



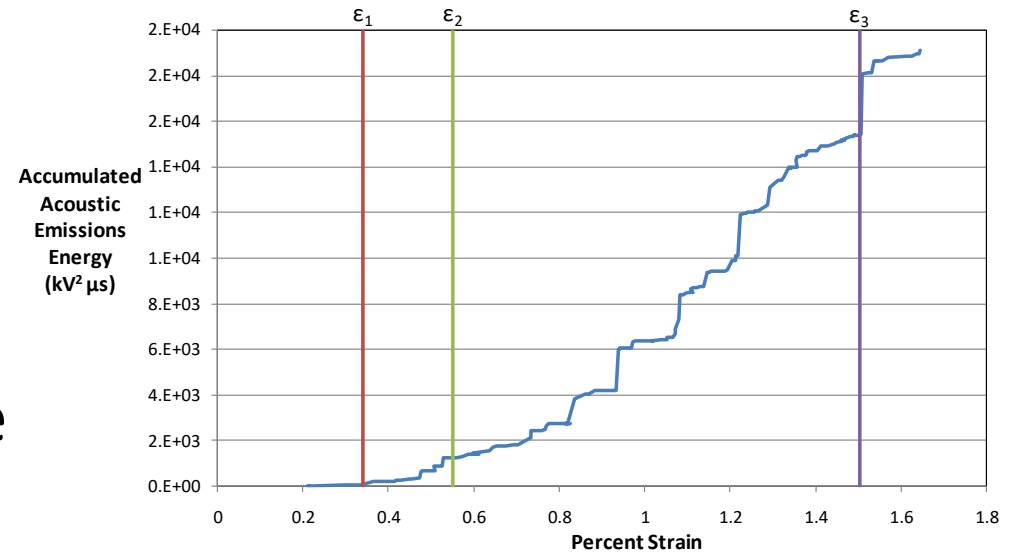
# Finite Element Method Background

- Numerical method
- Breaks part into elements
  - Retain the properties of the whole part
- Used to solve complex problems



# Previous Research

- Lomov, Ivanov
  - Acoustic emission
  - Strain mapping
  - X-Ray
  - Location of damage



# University of Wyoming's Progress

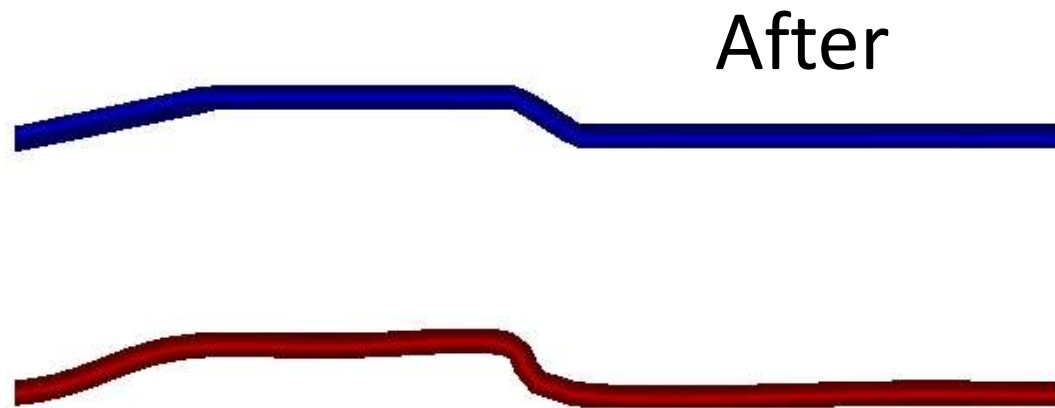
- Working model
  - Python code generates model within Texgen
  - Fortran code modified boundary conditions
  - ABAQUS model created
  - Volume average code written to validate

# Model Contributions

- Straightening the braids
- Material properties dependence on:
  - Fiber volume fraction
  - Number of nodes
- Generate results for failure predictions

# Model Contributions Straightening Braids

- Fully Defines Model

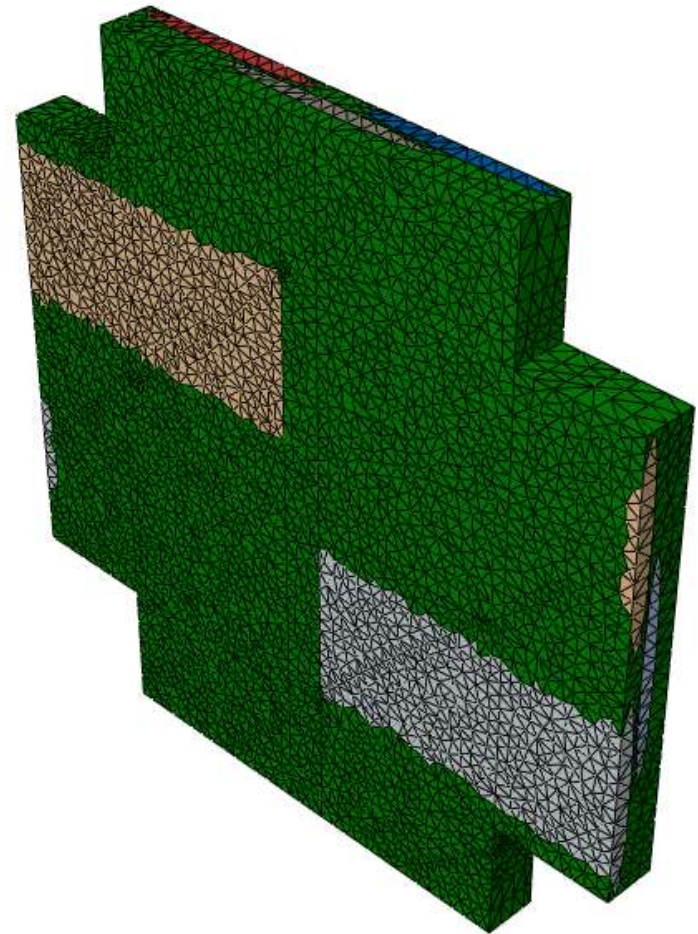


- Smaller Volume Average
- Eliminates Nesting



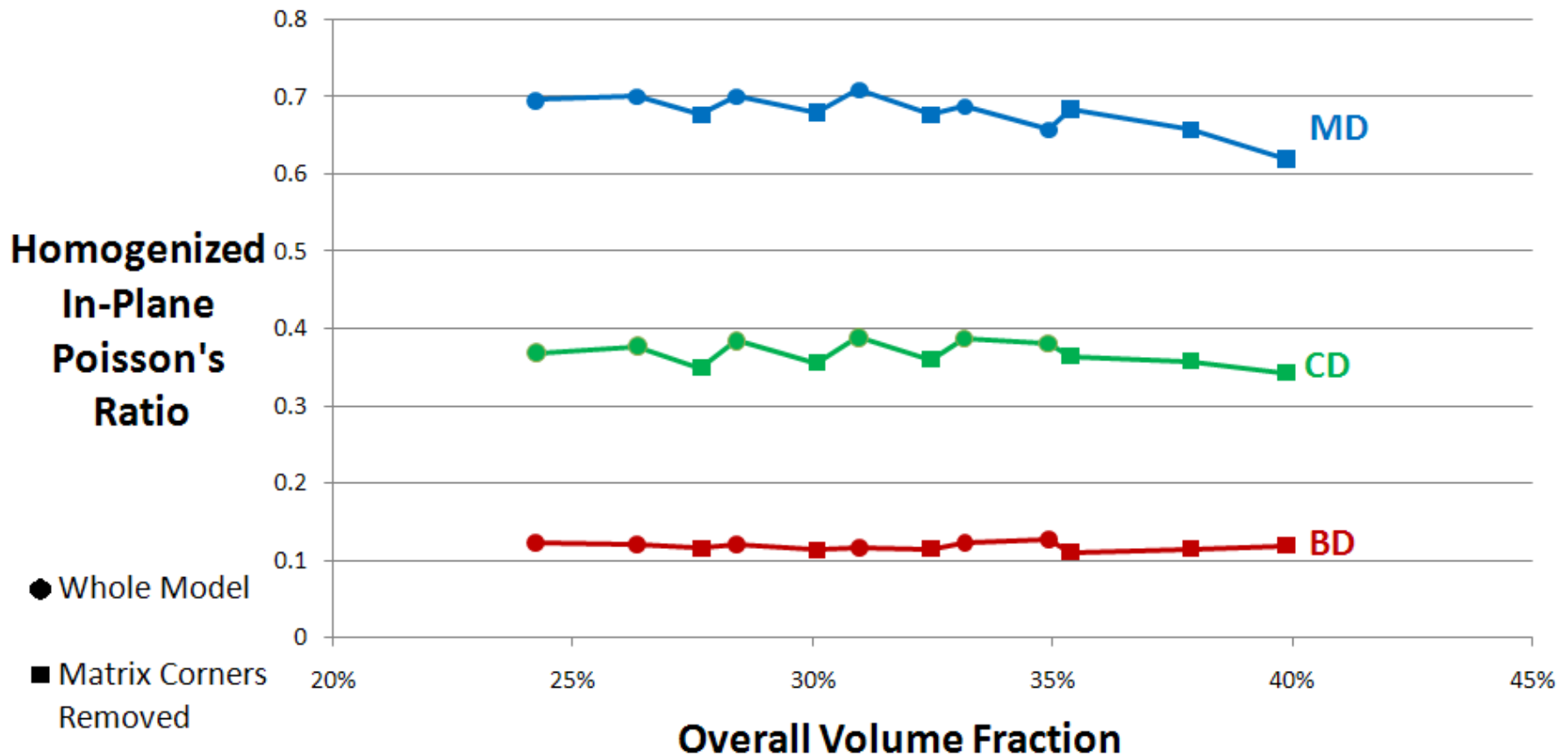
# Model Contributions Increasing Volume Fraction

- Removed Corner Matrix
- Required for conclusions to be made based off of experimental results.



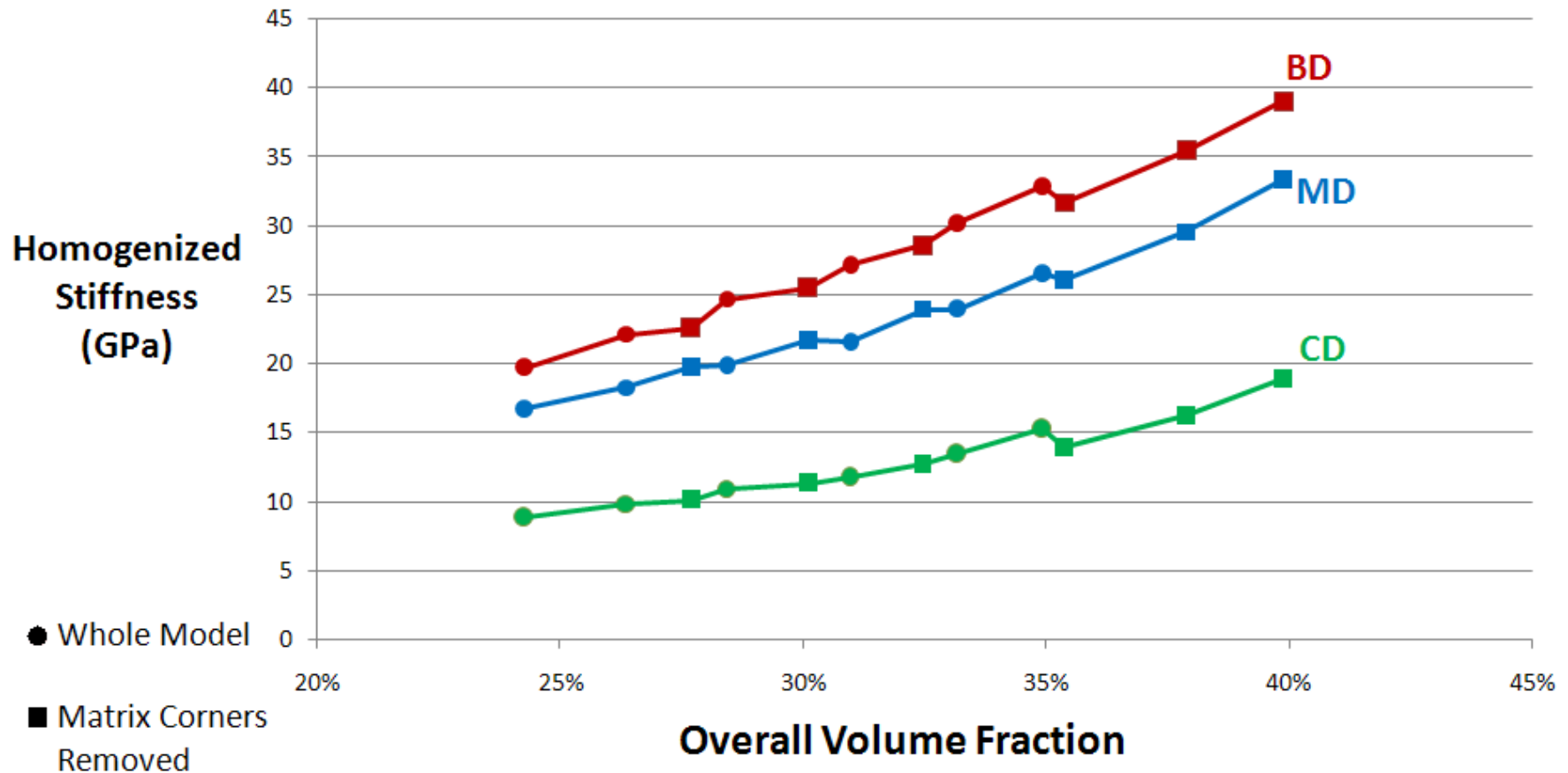
# Model Contributions

## Poisson's Ratio vs. Volume Fraction



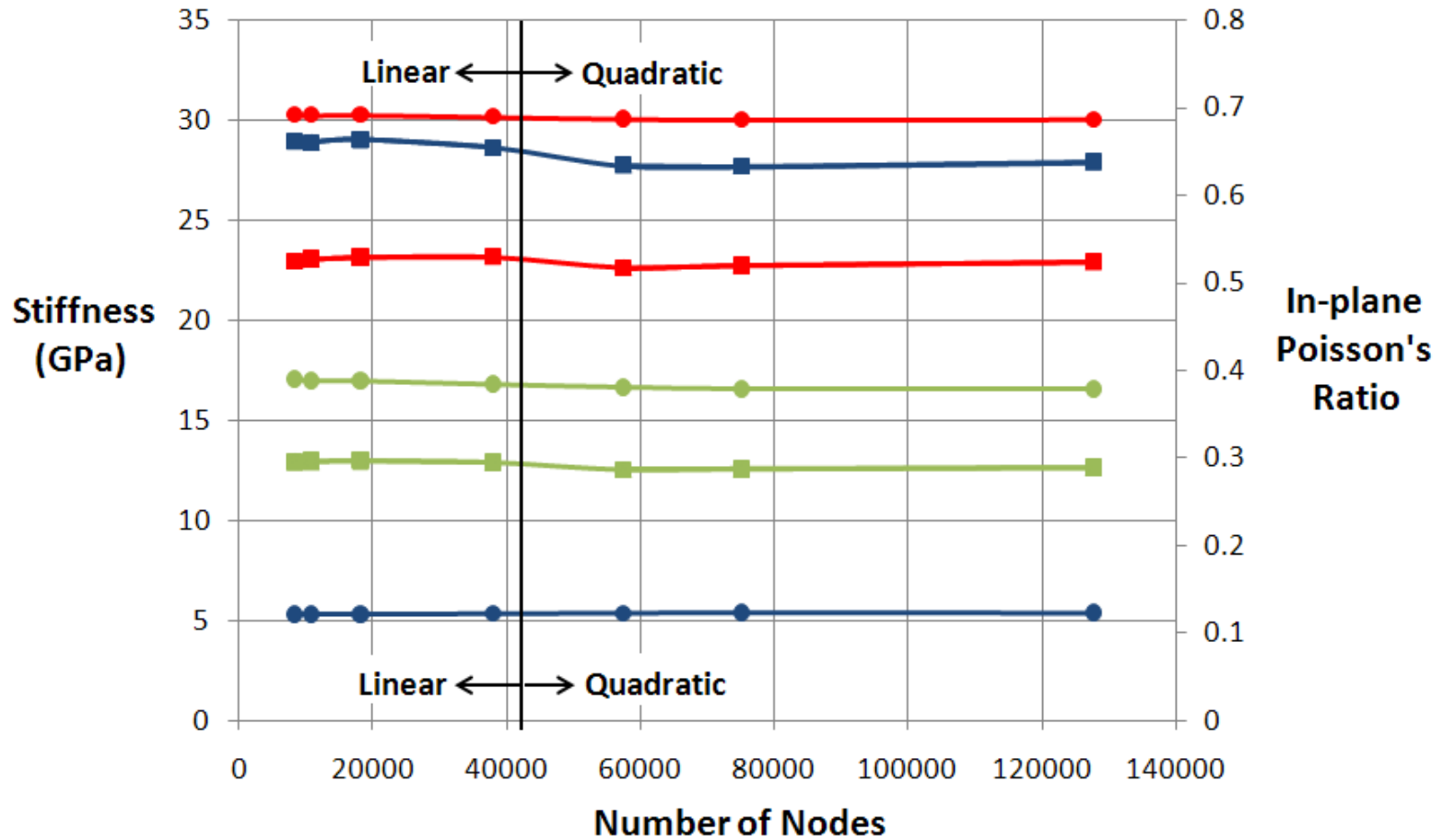
# Model Contributions

## Stiffness vs. Volume Fraction



# Model Contributions

## Effect of Increasing Complexity of Model



■ MD Stiffness

■ BD Stiffness

■ CD Stiffness

● MD Poisson's Ratio

● BD Poisson's Ratio

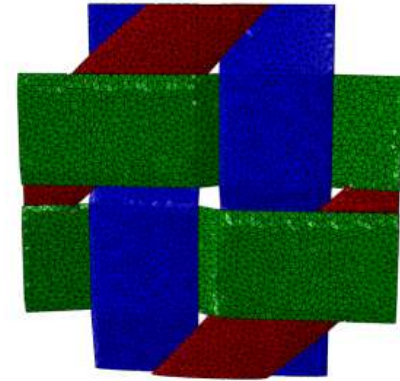
● CD Poisson's Ratio

# Conclusions

- Straightening of the braids allowed for the stresses to be broken down into various sections.
- Poisson's ratio does not depend on volume fraction.
- Stiffness depends on the volume fraction

# Conclusions

- Neither stiffness or Poisson's ratio depends on the number of nodes.
- Failure Criterion
- Validation of experimental results



# Questions?

