

# 3D Printed Auxetic Honeycombs: Investigation of fatigue behavior and interface characteristics in fiber-reinforced meta materials



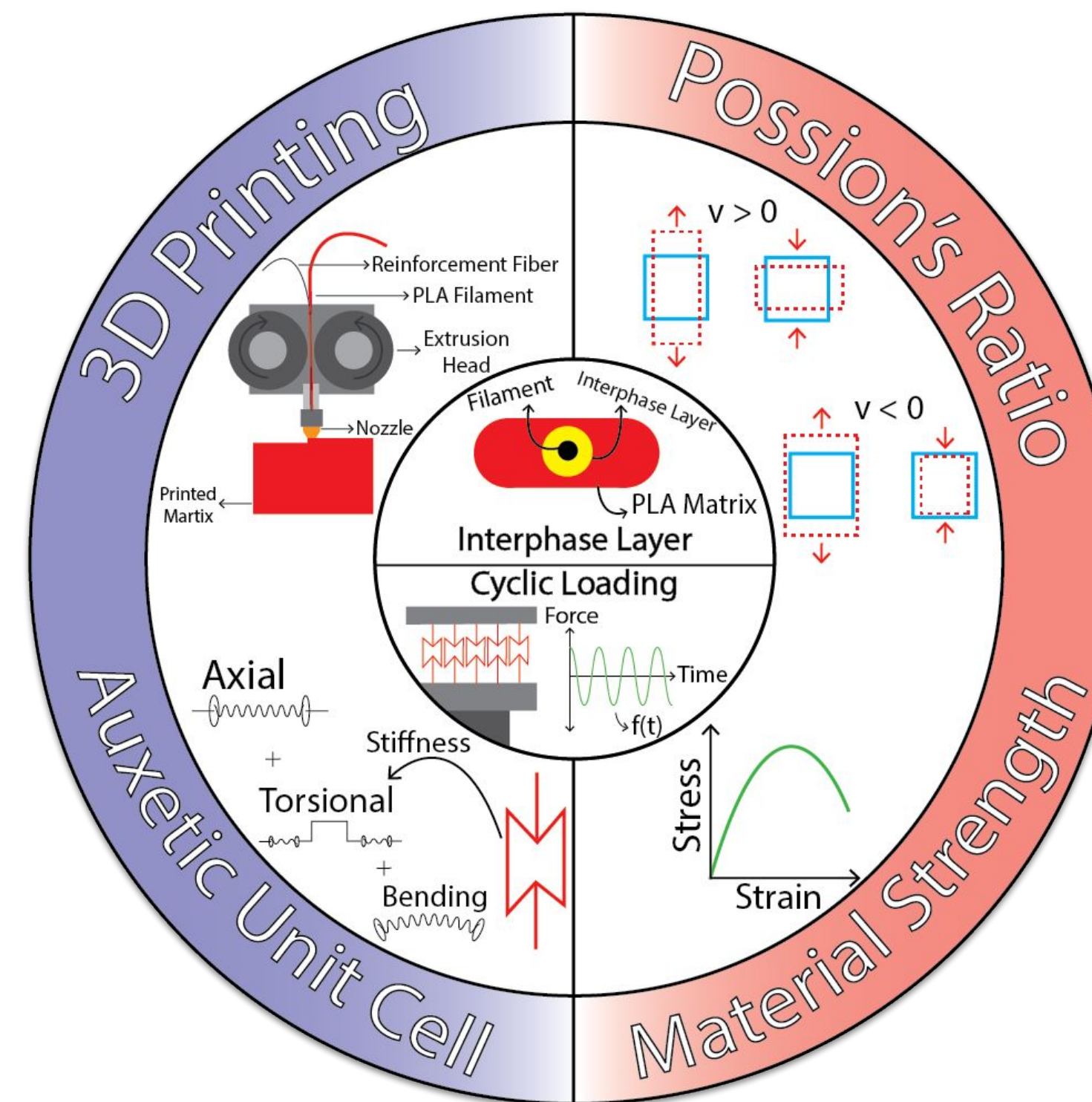
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## Objective:

This project characterizes the mechanical behavior of 3D-printed, fiber-reinforced auxetic honeycombs with modified unit cell geometry through finite element and experimental analysis.

## Background:

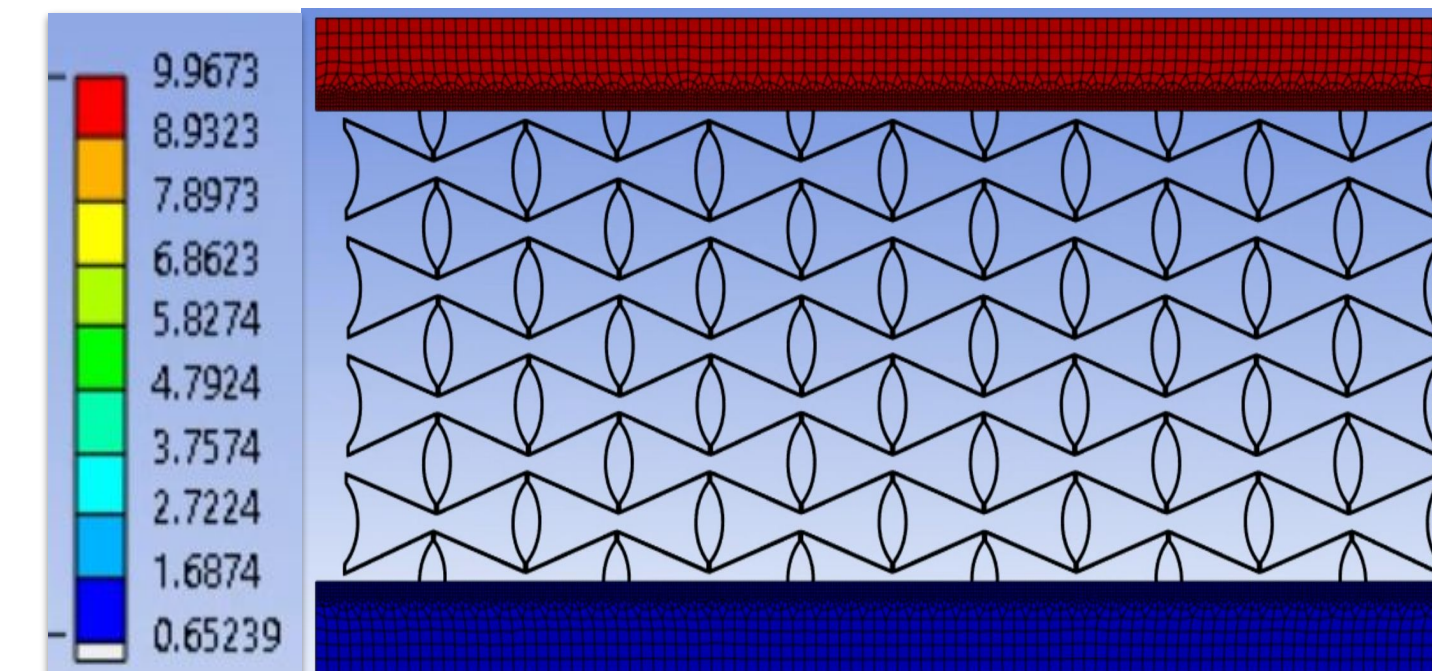
- 3D printing is a manufacturing technique being utilized in the development of metamaterials, including auxetic structures, 4D printing, and origami-based designs.
- Auxetic materials exhibit a negative Poisson's ratio due to their novel geometric lattices, making them ideal for applications requiring high specific strength or high energy absorption.
- The purpose of this project is to expand current research by investigating the fatigue behavior, the influence of a novel unit cell geometry, and the material interphase layer.



## Future Work:

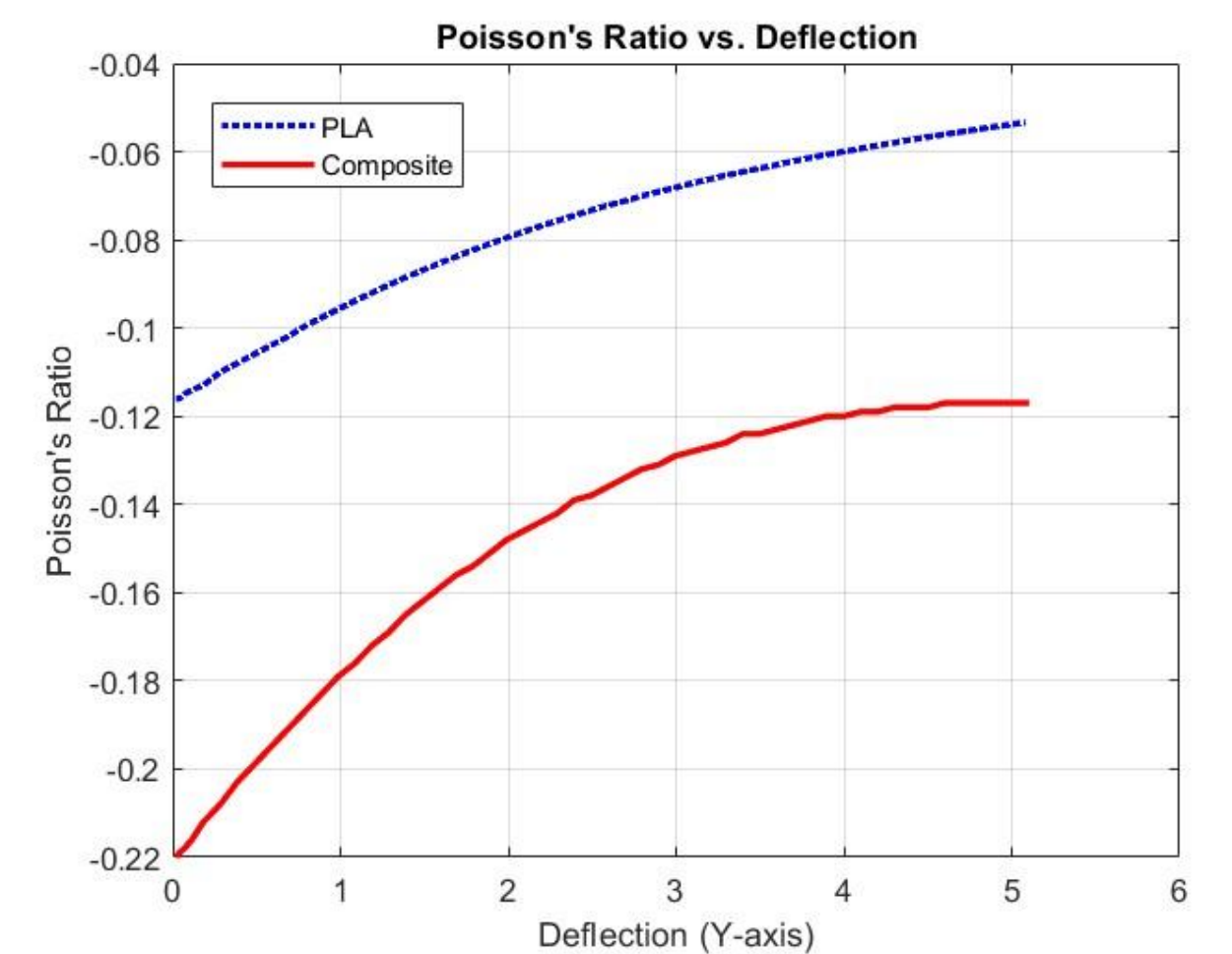
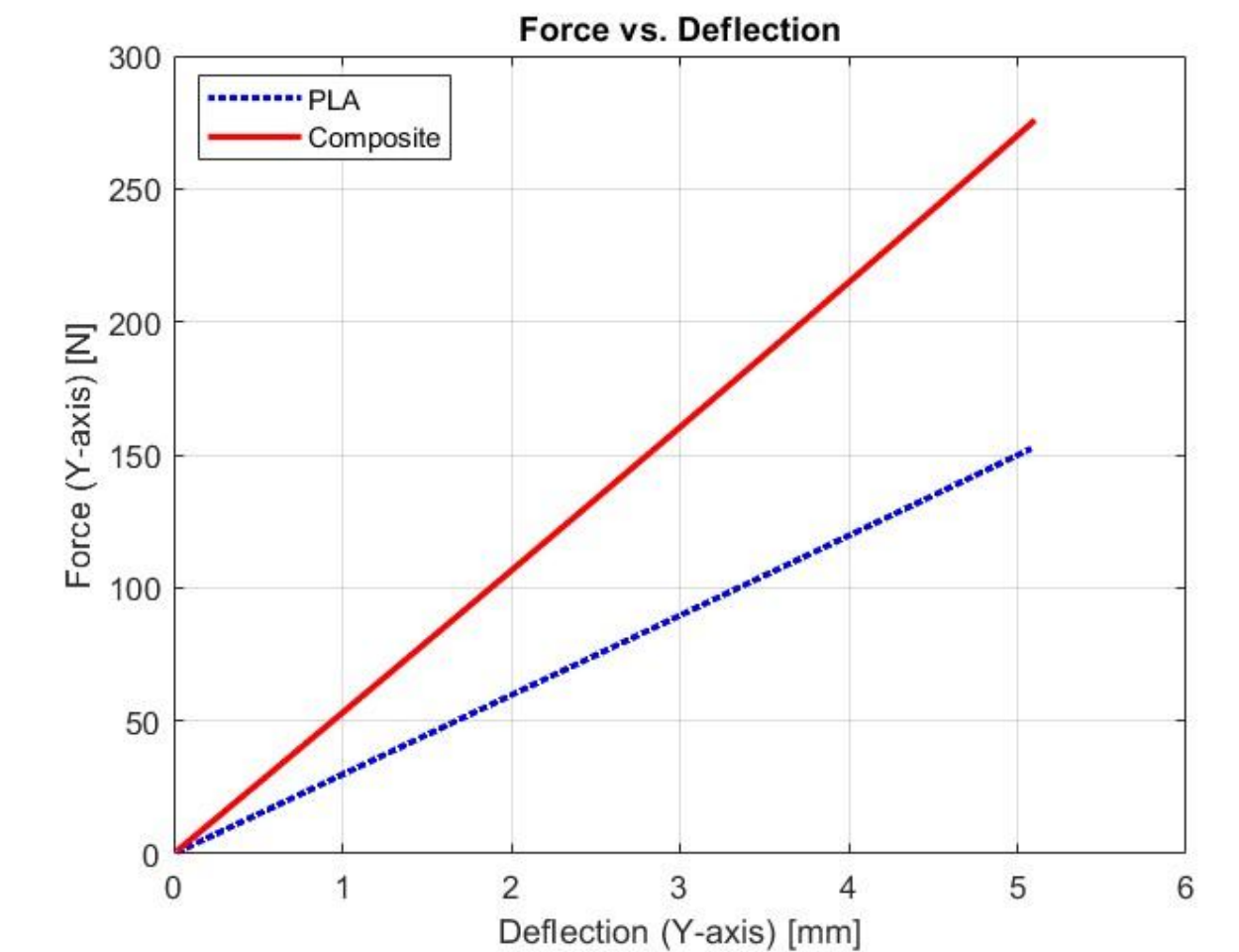
- Preform finite element modeling of the fatigue and hyperelastic behavior exhibited by the lattice structure.
- Manufacture the lattice structure using fiber-reinforced fused deposition modeling.
- Perform a real-world replication of the numerical model.
- Analyze the interphase layer between the reinforcement fiber and thermoplastic using atomic force microscopy.

## Y-Axis:

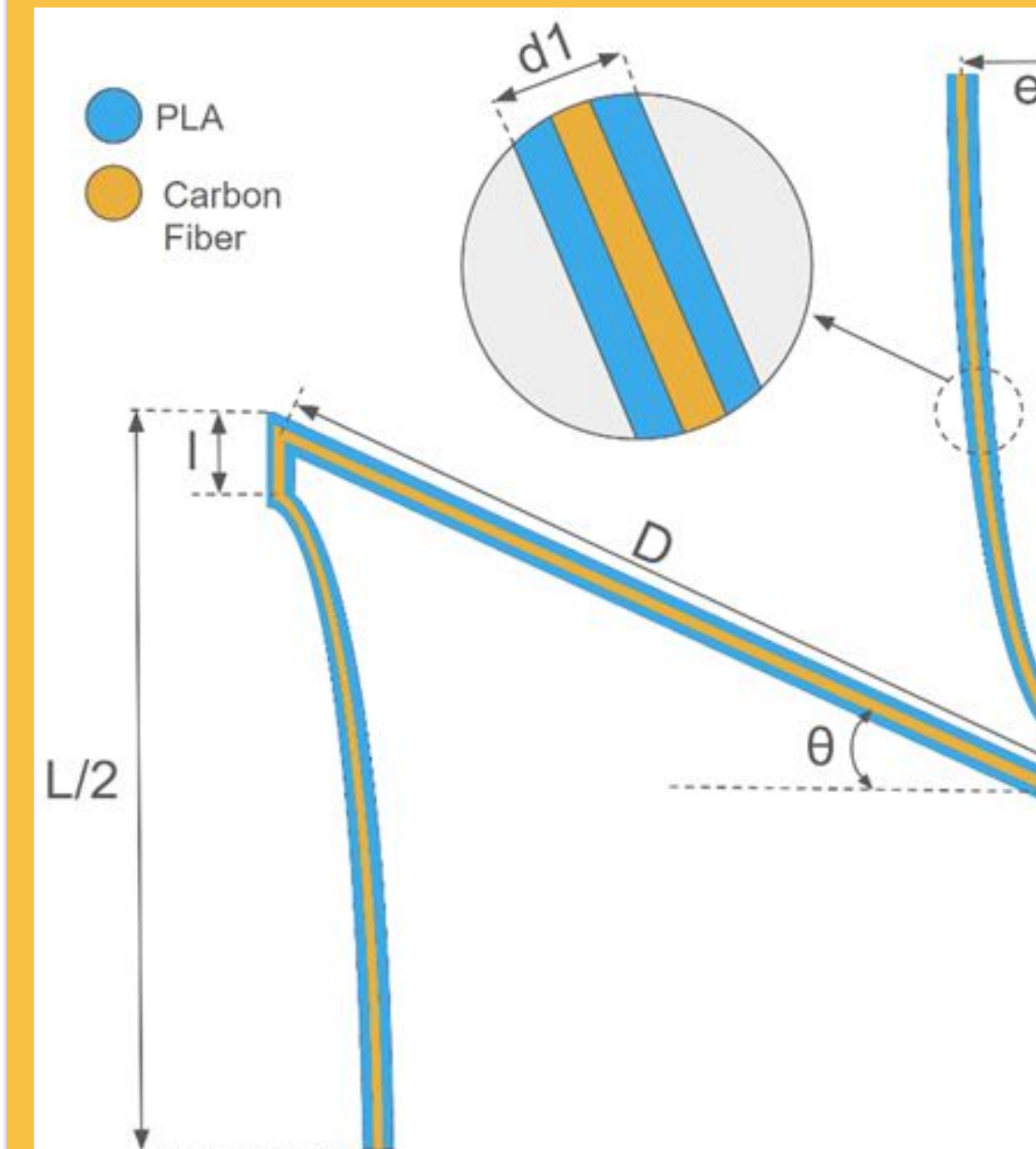


## Stiffness Along Y-Axis:

PLA: 29.8 N/mm  
Composite 52.9 N/mm



## Geometry (1/4 Unit Cell):



## Dimensions (Unit: mm):

L	l	e	$\theta$	D	d1	df	dp
33	3	5	25	40	0.92	0.46	0.46