DESIGNING AN ORTHOGONALLY NON-EXPANDABLE METAMATERIAL
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INTRODUCTION & PURPOSE

Metamaterials: Engineered materials with unique properties due to specific structures

Orthogonal metamaterial: designed with perpendicular and right angle features

METHODS

1. Design: create a unit cell in SolidWorks & repeat it to develop a rectangular material
2. Simulate: import design into abaqus to evaluate Poisson's ratio & functionality of design (ability to expand/extend)
3. 3D print: Print design using resin
4. Test: Using a material testing machine, we can determine the materials displacement capacity before cracking from applied force (pull) and generate a plot

RESULTS

The displacement curve plot allows us to calculate the young's modulus & indicates that the material is brittle due to it's straight-line behavior. Brittle Materials have a higher Young's Modulus indicating greater resistance to deformation. They also exhibit controlled fracture behavior but have limitations such as low impact resistance due to the inability to absorb enough energy.

When tested, the material fractured towards the end instead of in the middle. This points to structural flaws that occurred during the 3D printing process like the presence of air bubble.s

SKILLS

Technical: SolidWorks for designing 2D & 3D parts, Abaqus for running simulation
Soft: I had to create multiple iterations of my design with varying techniques that required flexibility and creativity

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CITATIONS