

# Nature's Blueprint: Bio-Inspired Lattice Structures vs Conventional Engineering

**Context Summary:** Researchers compared three lattice topologies manufactured via VAT photopolymerisation to evaluate their compressive response. The study highlights how mimicking the *Euplectella aspergillum* sea sponge creates a more stable, high-performance structure than traditional designs.

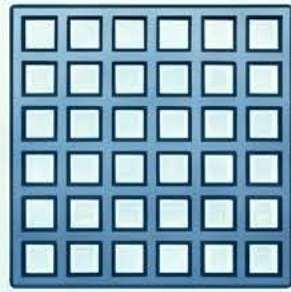
## Bio-inspired Architecture

Design derived from the deep-sea sponge *Euplectella aspergillum* to optimise energy absorption.



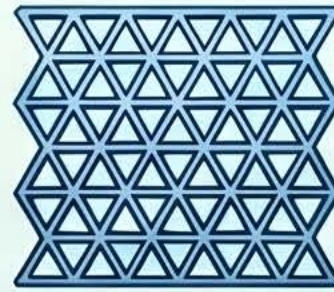
## TOPOLOGY COMPARISON

### Conventional Geometries

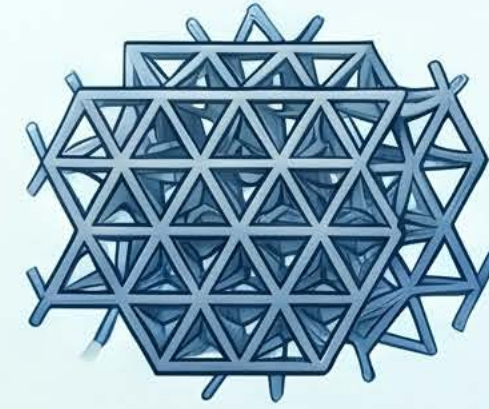


#### Square Lattice

Standard square and triangular lattice configurations served as the mechanical performance baseline.

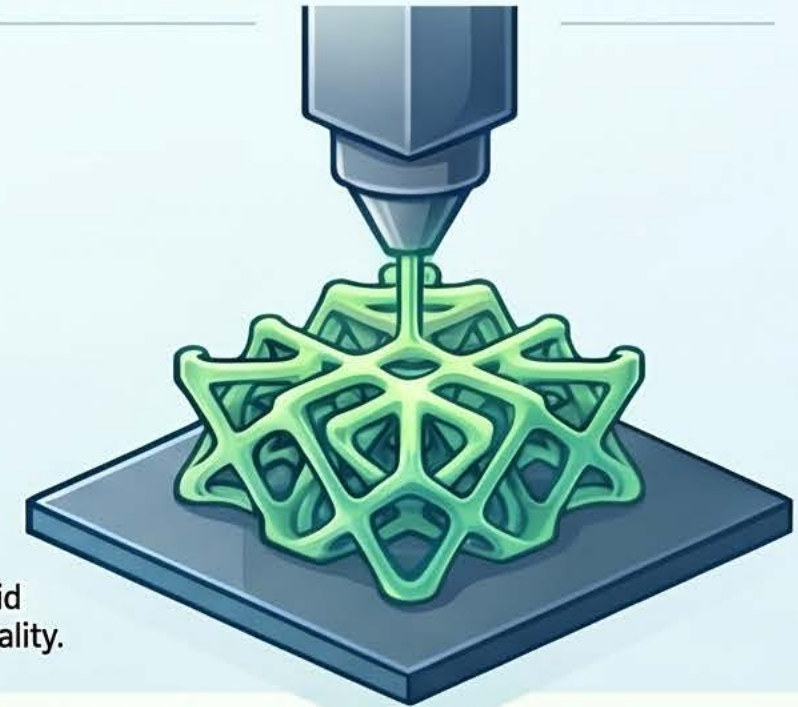


#### Triangular Lattice



#### VAT Photopolymerisation

High-resolution 3D printing using liquid resins to ensure precise geometric quality.



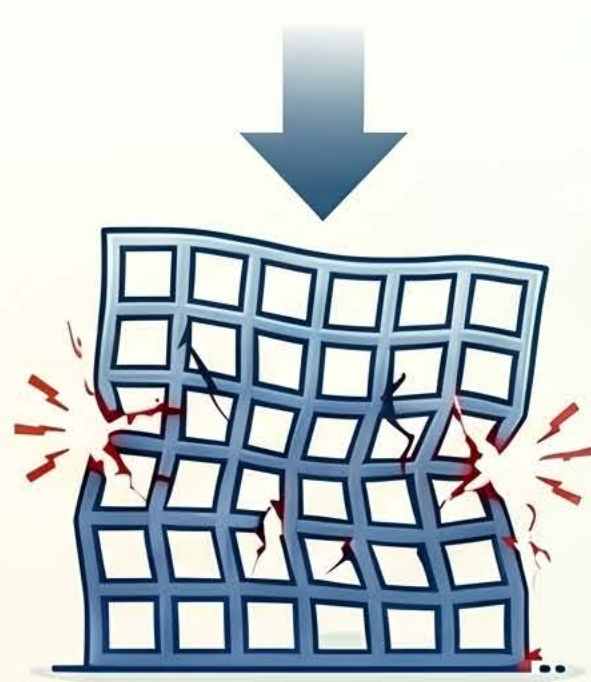
## MECHANICAL PERFORMANCE RESULTS



**5.2x**

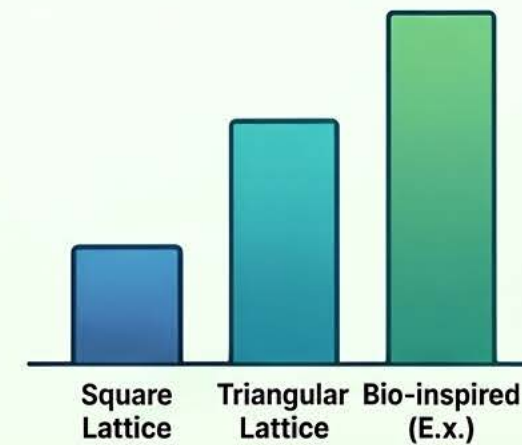
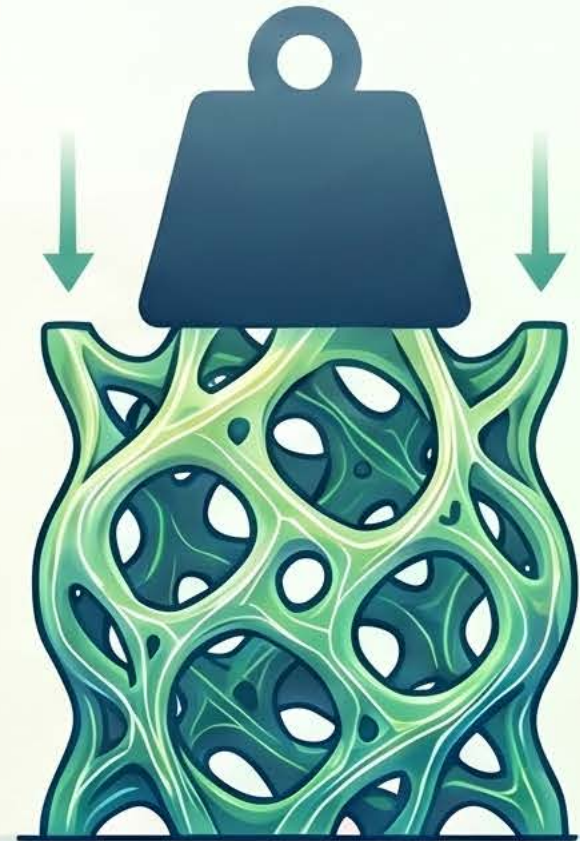
### Greater Critical Load

Bio-inspired structures resisted loads over 5.2 times higher than the square lattice baseline.



### Buckling Suppression

The bio-inspired geometry prevents the structural instability (buckling) seen in conventional designs.



**37.6%**

### Stiffness Increase

Bio-inspired lattices showed significantly higher stiffness compared to the square lattice reference.

### Direct Comparison: Experimental Failure Loads & Stiffness

Lattice Topology	Avg. Max Load (N)	Stiffness (N/mm)
Square Lattice	938	2068.2
Triangular Lattice	2980	2597.8
Bio-inspired (E.a.)	4887	2846.4