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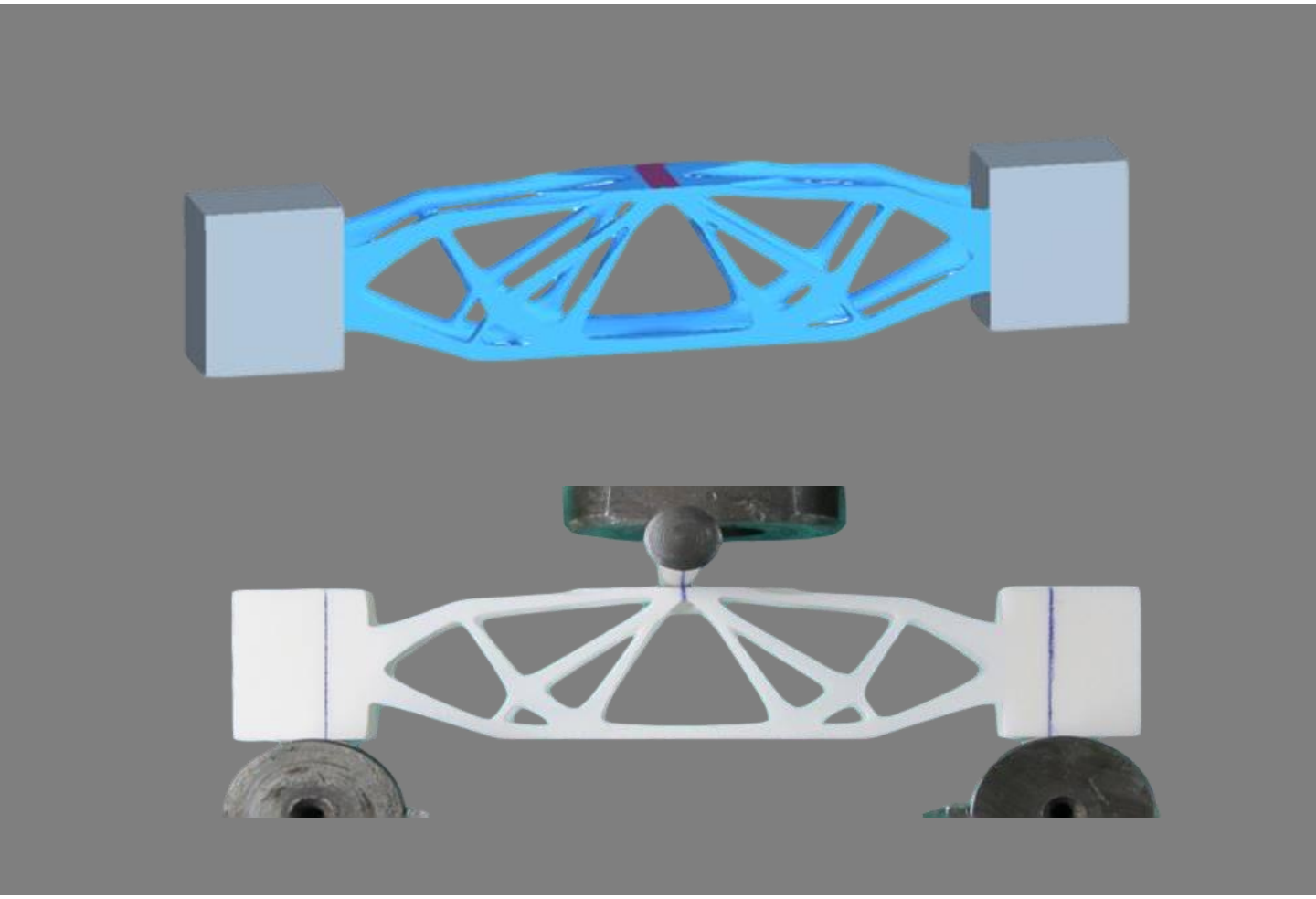


Optimization of solid and lattice structure three-point bending test: numerical and experimental results

PTC® PartnerAdvantage SILVER

DESIGN AND OPTIMIZATION

Lattice generation, optimization, surface smoothing and export to STL by **ProTOp®.**

NUMERICAL VERIFICATION

PTC Creo Simulate®

3D PRINT

Machine: EOS Formiga P100

Material: Fine Polyamide PA 2200 for EOSINT P.

TEST

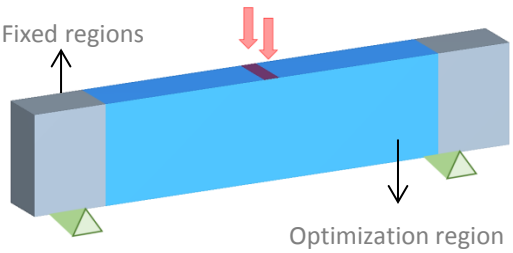
Machine: Universal hydraulic testing machine INSTRON 8500

Test type: three-point bending

Temperature: of room

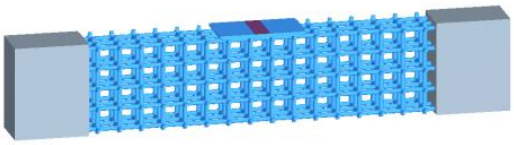
Loading type and speed: displacement; 2 mm/min

- CAD Model

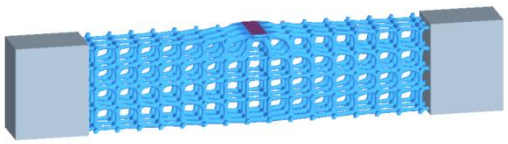


- Structures

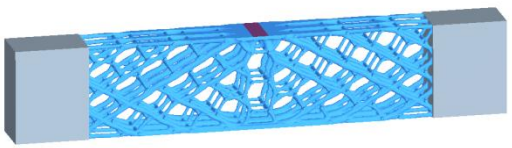
DESIGN: D0
CONFIGURATION: LATTICE - RECTANGULAR
OPTIMIZED: NO



DESIGN: D1
CONFIGURATION: LATTICE - RECTANGULAR
OPTIMIZED: YES



DESIGN: D2
CONFIGURATION: LATTICE - HONEYCOMB
OPTIMIZED: YES



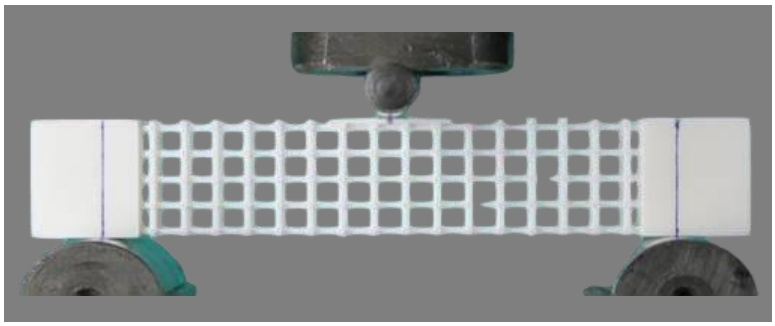
DESIGN: D3
CONFIGURATION: SOLID
OPTIMIZED: YES

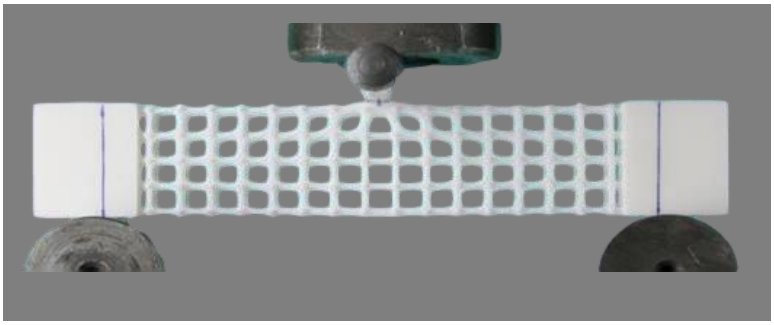
Does ProTOp® perform real topology optimization of a shell/lattice structure or is this only shape optimization?

ProTOp ® always performs proper topology optimization. Thus, any region of a shell/lattice structure can emerge from a void or completely vanish, unless the user prevents this by prescribing lower limits on thicknesses. In fact, running topology optimization on a shell/lattice structure without any thickness limitations ultimately yields the same optimal design as obtained by optimizing a solid model.

- Experiment Results

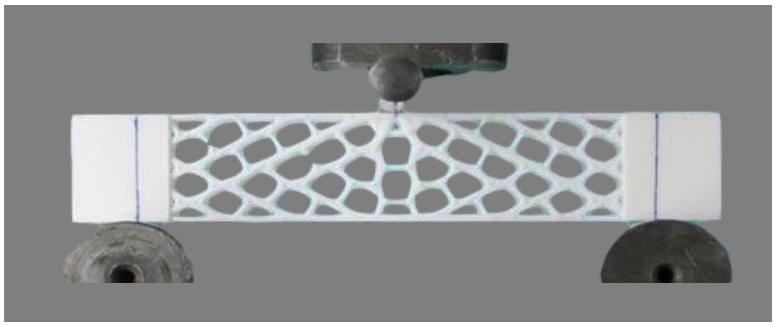
Design: D0
Volume part [%] : 12.9
Max displacement [mm] : 6.1
Approx. max. Mises stress [MPa] : 170

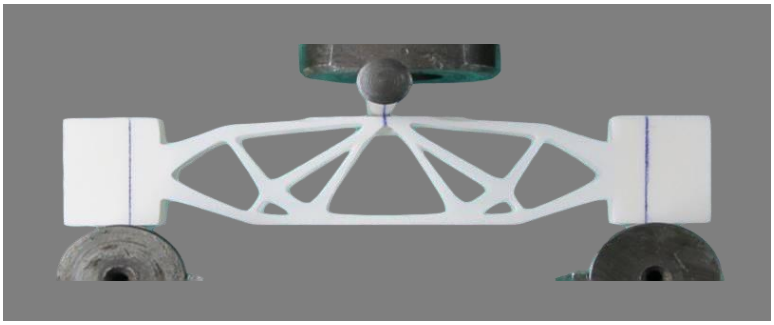




Design: D1
Volume part [%] : 11.8
Max displacement [mm] : 3.2
Approx. max. Mises stress [MPa] : 80

Design: D2
Volume part [%] : 12
Max displacement [mm] : 1.6
Approx. max. Mises stress [MPa] : 45

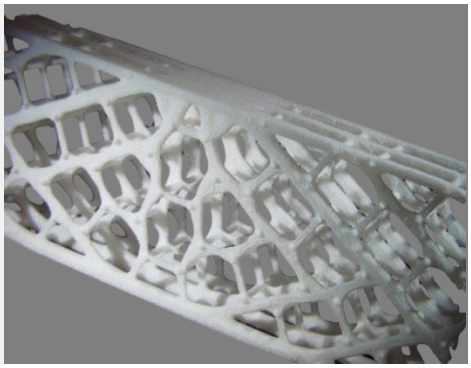




Design: D3
Volume part [%] : 12.1
Max displacement [mm] : 1.3
Approx. max. Mises stress [MPa] :25

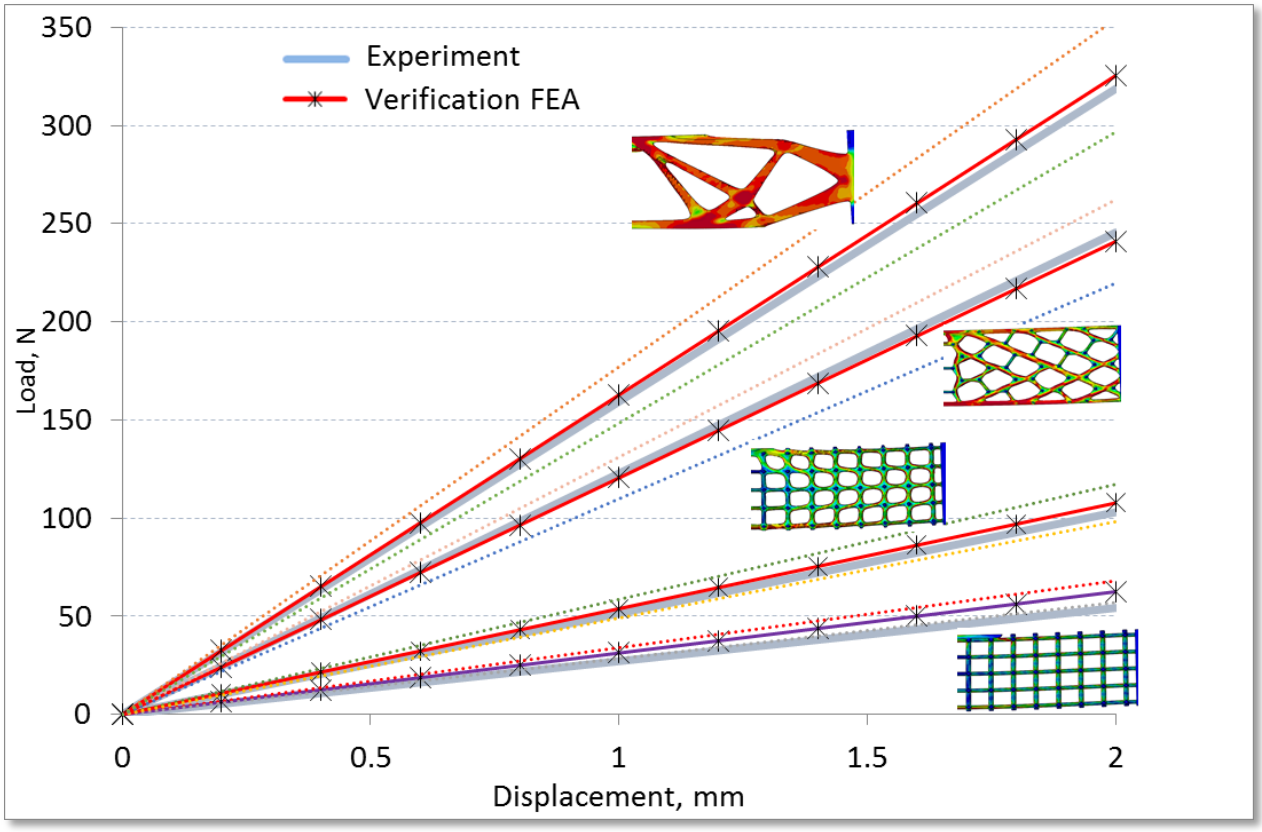
ProTOp® contains powerful configuration tools that can be used to reconfigure any solid region into a lattice, shell, or mixed shell / lattice / solid structure.

ProTOp® tools do this for you numerically - no CAD work is necessary.



Numerical and experimental* results comparison

Loading type/magnitude: DISPLACEMENT (as used for experiment)



*Experiments were performed at Institute of Mechanics, Faculty of Mechanical Engineering, University of Maribor

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