

Testing of 3D printed cellular materials with special geometries

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Abstract.

This paper analyzes the behavior of triply periodical metamaterial cells like Gyroid, Schwarz P and Schwarz D, which were designed by using the Rhinoceros 6 software. These topologies were printed using additive manufacturing and the SLA technique in cubic volumes, having dimensions of 25x25x25 mm. These cubes had different unit cell arrangements ranging from 1 unit cell and going up to 8-unit cells in each direction. The overall weight of the samples has been kept approximately constant as the increase in density will not affect the weight for each geometrical configuration. These cubes were subjected to static compression testing at a speed of 2 mm/min. Keeping the testing speed constant but increasing the cell density, the capable force and displacement were determined, and comparisons between the behavior of different structural topologies have been made. By analyzing the consecutive deformation modes one was able to observe the increase in overall stiffness of the components. Failure mechanisms have been studied by analyzing the way in which the cells collapse under the applied load.