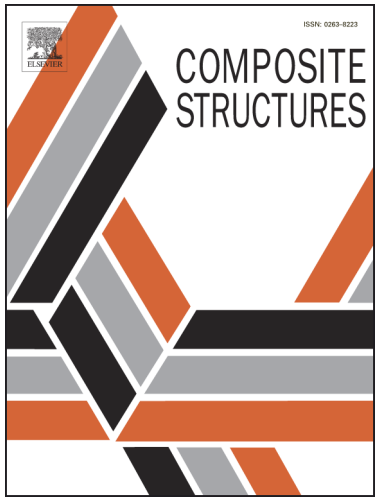
Journal Pre-proofs



Compression behaviors of 3D printed pyramidal lattice truss composite structures

Gaoyuan Ye, Hongjie Bi, Yingcheng Hu

PII: S0263-8223(19)33402-6
DOI: https://doi.org/10.1016/j.compstruct.2019.111706
Reference: COST 111706

To appear in: *Composite Structures*

Received Date: 10 September 2019
Revised Date: 7 November 2019
Accepted Date: 18 November 2019

Please cite this article as: Ye, G., Bi, H., Hu, Y., Compression behaviors of 3D printed pyramidal lattice truss composite structures, *Composite Structures* (2019), doi: https://doi.org/10.1016/j.compstruct.2019.111706

Compression behaviors of 3D printed pyramidal lattice truss composite structures

Gaoyuan Ye [a], Hongjie Bi [a], Yingcheng Hu [a,*]

[a] *Key Laboratory of Bio-based Material Science and Technology of the Ministry of Education of China, College of Material Science and Engineering, Northeast Forestry University, Harbin 150040, China*

[*] Corresponding author. E-mail address: yingchenghu@nefu.edu.cn; Tel: +86-451-82190394

Abstract: The lattice truss structure is a porous lightweight periodic structure with high specific stiffness and specific strength. In this research, pyramid lattice truss structures were designed and manufactured by three-dimensional (3D) printing technology through horizontal printing and vertical printing manners, respectively. Quasi-static axial compression tests were conducted to study the mechanical properties and energy absorption of the pyramidal lattice truss structures. These two types of printed lattice truss materials had close strength and rigidity. However, the vertically printed lattice truss structures had excellent ductility and their struts never broken off during compression. Three post failure styles of the vertically printed lattice truss structures were observed, including strain-hardening, stable deforming and softening and depending on the slenderness ratio of the strut. Theoretic analysis and finite element method (FEM) were performed to investigate the compression behaviors of the vertically printed lattice truss materials. Appropriate printing method and relative density could make the 3D printed pyramidal structures achieve excellent specific