

## Accepted Manuscript

Low-velocity Impact Response of 3D-printed Lattice Structure with Foam Reinforcement

Yi-Tang Kao, Anish Ravindra Amin, Nolan Payne, Jyhwen Wang, Bruce L. Tai

PII: S0263-8223(17)33465-7  
DOI: <https://doi.org/10.1016/j.compstruct.2018.02.042>  
Reference: COST 9392

To appear in: *Composite Structures*

Received Date: 23 October 2017  
Revised Date: 7 January 2018  
Accepted Date: 19 February 2018

Please cite this article as: Kao, Y-T., Ravindra Amin, A., Payne, N., Wang, J., Tai, B.L., Low-velocity Impact Response of 3D-printed Lattice Structure with Foam Reinforcement, *Composite Structures* (2018), doi: <https://doi.org/10.1016/j.compstruct.2018.02.042>

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.



## Low-velocity Impact Response of 3D-printed Lattice Structure with Foam Reinforcement

Yi-Tang Kao<sup>a</sup>, Anish Ravindra Amin<sup>a</sup>, Nolan Payne<sup>a</sup>, Jyhwen Wang<sup>b</sup>, and Bruce L. Tai<sup>a,\*</sup>

<sup>a</sup>Department of Mechanical Engineering, Texas A&M University, TX, USA

<sup>b</sup>Engineering Technology and Industrial Distribution, Texas A&M University, TX, USA

### Abstract

This paper presents an experimental study on low-velocity impact response of bi-material structures (BMS). BMS is a structural composite consisting of a 3D-printed lattice structure filled with a reinforcement material. In this study, BMS is made of polylactide (PLA) lattice structure and polyurethane (PU) foam for an enhanced impact resistance. Three different PU foams, including one rigid foam and two flexible foams, are selected for BMS. The impact tests are conducted to compare the impact attenuation, stiffness, toughness, and strength using the measured rate of change of acceleration (known as “jerk”), displacement, energy absorption, and the maximum acceleration, respectively. The results show that flexible foams have more positive effects on the impact properties than the rigid foam. The maximum reduction of jerk is about 9% compared to the baseline structure without foam reinforcement. The maximum displacement is increased by 17%; the maximum energy absorption is increased by 23%. The maximum acceleration remains similar for all samples. In conclusion, a proper selection of foam filling can significantly improve the impact properties.

**Keywords:** low-velocity impact; composite; 3D Printing; bi-material structure

---

\* Corresponding author at: Department of Mechanical Engineering, Texas A&M University, College Station, TX 77843-3123, USA  
E-mail address: btai@tamu.edu

Download English Version:

<https://daneshyari.com/en/article/6703591>

Download Persian Version:

<https://daneshyari.com/article/6703591>

[Daneshyari.com](https://daneshyari.com)