



Biomimetic impact-resistant structures by 4D printing technology

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Abstract:

In this Keynote talk, first, I will discuss some of our previous works on 4D printing. Second, I will talk about one of our future works about 4D printed bio-inspired impact-resistant structures. Some living creatures have demonstrated extreme features such as the high impact resistance that can be comprehended and utilized for design and fabrication of novel materials and structures. It is interesting to note that more than 90% of the living space (biosphere) of Earth belongs to the ocean (where life began over 3.5 billion years ago); and about 95% of the ocean is still unexplored, according to NOAA (National Oceanic and Atmospheric Administration). Researchers have already been inspired by living things for fabricating impact-resistant composites. These bio-inspired structures usually have complex geometries. Therefore, the researchers used 3D printing to fabricate them. The bio-inspired impact-resistant structures proposed in the literature are mainly static. Now, I propose 4D printed bio-inspired impact-resistant structures that can evolve over time. This evolution (change over the fourth dimension) can enhance bio-inspired impact-resistant structures from three main aspects. First, it can help to absorb the impact energy to decrease the failure. Second, it can create a situation for the structure to be self-repair. Third, some types of smart materials can be engaged to even convert the terrible impact force and energy to useful things and outputs. These three features are embedded into structures by elaborating smart materials via mathematics and additive manufacturing and are enabled by stimulus (here is impact force/energy) through an interaction mechanism.



Biography:

Farhang Momeni is Postdoctoral Research Fellow in Mechanical Engineering at the University of Michigan-Ann Arbor. He finished his B.S. in three years rather than the usual four years (Sep 2011-Sep 2014) in Aerospace Engineering at the Sharif University of Technology (SUT), while he was ranked 1st among all B.S. students in Aerospace Engineering at SUT that graduated in 2014. During his B.S., he published two journal articles. In 2015, he received direct Ph.D. admission with Fellowship award from the Mechanical Engineering department at the University of Michigan-Ann Arbor, where he obtained his M.S. and Ph.D. in 2017 and 2018, respectively.

Recent Publications:

1. Momeni, et al; Rev Med Virol, 2019
2. Momeni, et al; J Cell Physiol, 2019
3. Momeni, et al; Curr Med Chem, 2019
4. Momeni, et al; J Cell Physiol, 2018
5. Momeni, et al; J Res Med Sci, 2018

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