Additively Manufactured Tensegrity Assisted Inflatable Structures (AMTAIS)

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Natural Sciences & Engineering Oral Presentation

Abstract: Inflation with customization: this research introduces a novel manufacturing process to produce inflatables with tailorable properties. Additive manufacturingâ€”especially Fused Deposition Modelingâ€”allows for rapid fabrication of almost any geometry imaginable. This research answers the question: can customizable inflatable structures be consistently fabricated using a novel additive manufacturing technique? Here, we introduce additively manufactured tensegrity assisted inflatable structures (AMTAIS). Fabricated using a patent pending design and manufacturing process, each structure maintains its complex shape after inflation. Using flexible material, airtight walls are printed to any user-specified geometry. Then, the G-codeâ€”or the set of printing instructionsâ€”is modified to incorporate fibrous tethers within the internal cavity. These tethers prohibit the structural walls from expanding, allowing the structure to hold its shape post-inflation. A valve is inserted into the AMTAIS to allow inflation using any standard bike pump. This technique permits the production of a myriad of inflatable shapes with improved load-bearing properties. The inflated structures can hold pressure for weeks, and can be folded for storage when not in use. As a lightweight alternative to current solid structures, these enhanced inflatables could offer strong commercial value, from aerospace applications to the fashion industry. These structures have already proven to be effective bespoke handbags that protect the user's devices from accidental falls. By redefining the future of tensegrity assisted inflatables, this research provides further innovation within the realm of 3D printing.

Faculty Mentor: *Bhisham Sharma*