Deployable Tensegrity Pavilion with Inflatable Struts

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Abstract

This paper presents research on a hybrid structure system that extends the principles of active-deployed tensegrity structures through the use of inflatable compression struts, demonstrated through a pavilion being submitted to the WG21 lightweight pavilion exhibition. The pavilion combines advantages of tensegrity and pneumatic structures, resulting in a minimum weight structure that maximizes its global volume change. Previous deployable tensegrity structures have used external actuation and rigid materials for compression elements, resulting in a minimal shape-change capacity. Other prototypes for inflatable tensegrity systems have also been proposed [1], but used continuous air flow systems and built at very small scales. This pavilion [Figure 1] uses a common tensegrity geometry in order to maximizes the scale of the cable-stabilized inflatable compression members. The large, low-pressure struts were developed to maintain their internal air pressure and resist buckling which results from loading the structure. Lighting systems integrated into the actuating end caps of the struts author them with different lighting patterns. This paper will discuss the pavilion and the numerous scale prototypes that precede it, present testing results and analytical strategies for the struts, and speculate on the range of applications for this technology – ranging from fixed long-span applications to rapidly deployable bridges, towers and disaster relief structures.

References

[1] H. Furuya, et al. "Concept of Inflatable Tensegrity for Large Space Structures" *in Proceedings to the 47th American Institute of Aerospace and Aeronautics Conference*, Newport USA, 2006.

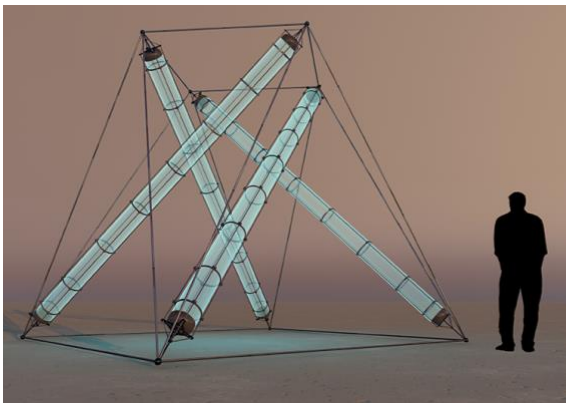

Figure 1. Preliminary design rendering of the proposed pavilion with cable-stabilized inflated struts and internal lighting.

Figure 2. Half-scale tensegrity prototype with inflated polyethylene air-struts.