Adjustable and Deployable Tensegrity Assur Structures/Robots and their applications for the space industry.

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The space industry has manifested increasing interest in tensegrity structures. *Tensegrity* is a contraction of "tensional integrity," and tensegrity structures consist of elements that can sustain only one type of force: tension (in the case of cables) or compression (in the case of struts). These types of structures are very light and can sustain external loads only when inner self-stress is maintained, thus making them indeterminate structures.

In our laboratory we corroborated and built what is called Tensegrity Assur Structures. In Assur structures removing any bar or joint from these structures results in a mechanism. In addition to this minimalism property, these structures, although determinate, possess self-stresses since they can constantly remain at the singular position. This property exists only in these types of structures, as was mathematically proved in 2010. Replacing struts with actuators enables us to build new types of deployed structures (Figure 1) which can be folded down to a very small size (Figure 2). Because they are compact and relatively light (all the elements except the actuators are cables and they are determinate structures) they have many applications in the space industry.

These structures have another unique property. They can be either soft/loose or rigid. When the structure needs to be rigid and sustain external loads, they can be activated at their singular position. This position employs self-stress to achieve rigidity. When the structure needs to be soft, one of the cables can be loosened causing the structure to be at a non-singular position. We are now considering the use of these structures, with their unique properties for the design and construction of a mechanical caterpillar robot, shown in Figure 3.

Figure 1

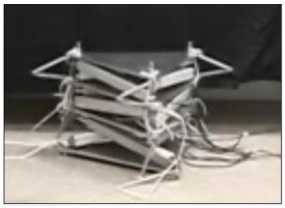

Figure 2

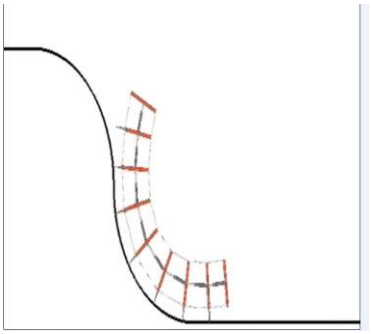

Figure 3