Nonlinear Analysis of Tensegrity Structures

Jingyao ZHANG[1*], Makoto OHSAKI[2]

[1*]Nagoya City University
2-1-10, Kita Chikusa, Chikusa-ku, Nagoya, 464-0083, Japan
zhang@sda.nagoya-cu.ac.jp

[2] Kyoto University, Japan

Abstract

The term *tensegrity* refers to the structure composed of continuous tensile members (cables) and discontinuous compressive members (struts) [1]. Tensegrity structures are usually unstable, due to their being kinematically indeterminate, in the absence of prestresses. It is the introduction of prestresses, tension or compression, into the members that stabilizes these structures [2].

The process of determination of the self-equilibrated configuration associated with the distribution of prestresses is called *form-finding* or *shape-finding*, which is one of the key problems in the design of tensegrity structures. In the first part of this study, we demonstrate that the non-linear analysis approach is able to find the expected self-equilibrated configuration of complicated tensegrity structures (Figure 1) within acceptable computational costs.

In the second part, we go further to investigate some example tensegrity structures by enforced deformations: the star-shaped structure in Figure 2 exhibits multi-stable behavior; the tensegrity lattice in Figure 3 constructed from octahedral structure is used for planet lander.
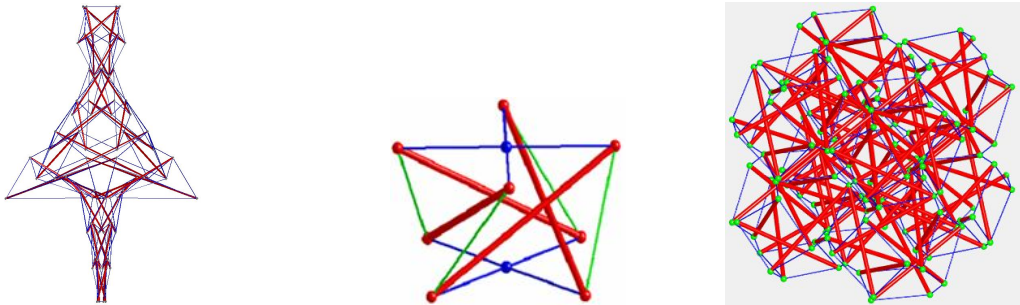
Figure 1. Self-equilibrium   Figure 2. Multi-stable structure   Figure 3. Tensegrity lattice

References

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