Integrating Structure and Control Design using the Tensegrity Paradigm

***†Robert E. Skelton**

Department of Aerospace Engineering, Texas A&M University, Texas, USA.

*Presenting author: bobskelton@tamu.edu
†Corresponding author: bobskelton@tamu.edu

Abstract

Tensegrity concepts have proven to be important in structure design, especially when minimal mass is required. Tensegrity also has key features that allow researchers to integrate structure and control design, by preserving controllable features during the structure design. This talk will present methods to facilitate this integration. First, we will show the exact nonlinear dynamics for any tensegrity system of any complexity, when the bars are treated as rigid and the strings are elastic. These methods select generalized coordinates to be vectors, not a set of scalars. The final equations of motion contain no transcendental functions, making computations more accurate. Secondly, we show a method called "Information Architecture" that automatically selects which strings should be controlled and which should serve as sensors. By integrating the multidisciplinary use of strings (structural members serving simultaneously as sensors and actuators), one can design structure to coordinate with control objectives to use the smallest control energy and the smallest structural mass to satisfy the performance objectives.

Examples will include an artificial gravity space habitat, an energy-absorber lander for Mars or the Moon, a robot design, and tensegrity platforms for launching mined lunar material into lunar orbit for utilization of in-space materials.

Keywords: **Tensegrity Structures, Information architecture, Sensors Selection, Actuator Selection**