#65 – 12-BAR TENSEGRITY SOFT ROBOT FOR NASA MISSIONS

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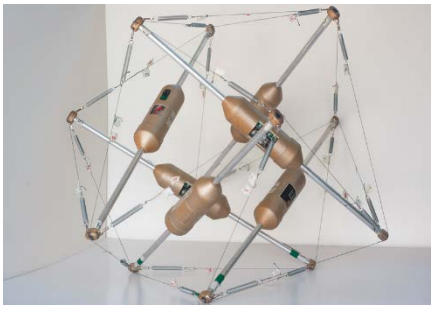

• Project Synopsis: NASA Ames is developing tensegrity robots for planetary surface exploration. The compliant tensegrity structure is made of only bars and cables (see image). It can be dropped onto a planetary surface, absorb the impact, and then move across the surface by actuating its cables. Thus it is a viable, low-cost replacement for traditional rovers, which require expensive landing gear to reach the surface.

Several prototypes of the robot have been made using a six-bar structure. They successfully demonstrated structural compliance and autonomous rolling locomotion. However, these prototypes revealed significant limitations to the six-bar structure, such as low actuation efficiency, high impact orientation sensitivity, and low payload-to-deadweight mass ratio. A twelve-bar structure, which is the next largest symmetric structure, is proposed to expand the robot's capabilities. This project seeks to design, construct, control, and evaluate a new tensegrity robot based on a twelve-bar structure.

More at: http://best.berkeley.edu/best-research/best-berkeley-emergent-space-tensegrities-robotics/.

- Technical Challenges:
  - Hardware design, manufacturing, and assembly
  - Electronics and sensor integration
  - Cable actuation scheme to achieve locomotion
  - Communications and controller implementation

- Tools and Equipment Provided:
  - Access to space, tools, and equipment in the BEST (Berkeley Emergent Space Tensegrities) Lab
  - Funding for supplies
  - Manufacturing equipment in the ME machine shop (with completion of training)
  - Prototyping equipment in Jacobs Hall and/or the CITRIS Invention Lab (with completion of training)
  - Open-source software for simulating tensegrity robots

• Project Deliverables:
- Functional 12-bar tensegrity robot with autonomous locomotion
- Review of design concepts and decisions

- Review of cable actuation scheme and methods used to develop it
- Performance evaluation of robot based on metrics of actuation efficiency, impact characteristics, and payload capability

• Ideal Team Size: 1-5 people

• Desired Skills: Enthusiasm for space and robotics. Design experience (CAD, failure analyses, manufacturing). Programming experience (Arduino). Electronics experience (component selection, PCB design, RF communication).