Increasing the Usability of the NASA Tensegrity Robotics Toolkit

Perry Bhandal
Supervised by Dr. Dorothea Blostein
School of Computing, Queen's University

Introduction

The NASA Tensegrity Robotics Toolkit (NTRT) is a public domain physics simulator used in the research, design and simulation of tensegrity robots.

The goal of my work is to make NTRT more widely usable.

Tensegrity

Tensegrity (tensional integrity) is a structural principle in which isolated components under compression are held in place by a network of components under tension.

Applications of tensegrity include art, furniture, architecture, and modeling of biological systems.

NTRT

NASA researchers are developing tensegrity robots for space exploration. Advantages:
- Light and inexpensive.
- Folds flat for transport.
- Land with a bounce, protecting its payload.

The development of these robots relies on a combination of computer simulation and physical prototypes.

Tensegrity robot simulated in NTRT

Code Improvements

Over the course of 221 commits to the NTRT master branch I have made the following improvements:

Defined Coding Standards; Refactored Code

Automated Testing Support
- Google Mock and Google Test used for unit and integration tests.
- Resource folder for test resources; helpers to load resources.

Continuous Integration of Code Modifications
- BuildBot used for automated build on every master commit. Ensures that code compiles, and that no unit or integration tests fail.
- Delivers up-to-date Doxygen documentation on successful build.

Tutorials for New NTRT Users

Improved Setup and Build Scripts
- Converted scripts from Bash to Python: step towards Windows support.
- More effective error prevention and recovery during setup and build.

Future Work

Allow tensegrity structures to be defined without code.
Support NTRT's use in non-robotic tensegrity applications, such as art, architecture, and biomechanics.