Tensegrity structures are comprised of rods and strings held together by tension. They have important applications in architecture, biology and robotics. In biomechanics, they are used to model arms, legs, spines, torsos, and other components of human physiology.

ArtiSynth is a 3D mechanical modeling program combining multibody and finite element simulation. It is open source and written in Java. The goal of this project is to create a framework in ArtiSynth to implement and simulate different types of tensegrity structures.

Implementation of tensegrity models in ArtiSynth is done through a custom Rod class and adjustments to the AxialSpring class.

Each Rod object is composed of two end markers and a rigid body. Each string is a modified spring that does not exert forces when compressed. New rods and springs can be created with the addRod and addSpring functions.

Below is the Java and YAML declaration for a 3-strut prism. YAML is the file format used by the NASA Tensegrity Robotics Toolkit (NTRT). A future goal is to translate between YAML and Java so that structures can be exchanged between NTRT and ArtiSynth.

**Java**
```java
// Rods
Rod bottom1top2 = addrod (mech, bottom1, top2, rad);
Rod bottom1top3 = addrod (mech, bottom1, top3, rad);
Rod bottom2top3 = addrod (mech, bottom2, top3, rad);

// Strings
addspring (mech, bottom1top2.marker1, bottom1top2.marker2, 1);  
addspring (mech, bottom1top2marker1, bottom1top2marker2, 1);  
addspring (mech, bottom1top3.marker1, bottom1top3.marker2, 1);  
addspring (mech, bottom1top3marker1, bottom1top3marker2, 1);  
addspring (mech, bottom2top3.marker1, bottom2top3.marker2, 1);  
addspring (mech, bottom2top3marker1, bottom2top3marker2, 1);
```

**YAML**
```yaml
nodes:
  bottom1: \([\-2.5, 0, 0]\)
  bottom2: \([0, 0, 5]\)
  bottom3: \([0, 0, 5]\)
  top1: \([-2.5, 10, 0]\)
  top2: \([2.5, 10, 0]\)
  top3: \([2.5, 0, 0]\)

prism_strings:
  - bottom1 - top1
  - bottom1 - top2
  - bottom1 - top3
  - bottom2 - top1
  - bottom2 - top2
  - bottom2 - top3
  - bottom3 - top1
  - bottom3 - top2
  - bottom3 - top3
```

Simulation of tensegrity structures is observed through ArtiSynth’s user interface. The structures are subject to gravity and can interact with a terrain and other objects. This is a useful tool for tensegrity model builders to visualize the structure and behavior of a large range of possible models.

**Simulation**
```java
Simulator sim = new Simulator (mech);
sim.setGravity (0, 0, -10);
sim.setField (0, 0, 0, 0);
sim.addContact (mat, world, body);
nodes:
  bottom1: \([-2.5, 0, 0]\)
  bottom2: \([0, 0, 5]\)
  bottom3: \([0, 0, 5]\)
  top1: \([-2.5, 10, 0]\)
  top2: \([2.5, 10, 0]\)
  top3: \([2.5, 0, 0]\)
```

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