Digital Assembly of Face-Connected Octahedral Columns

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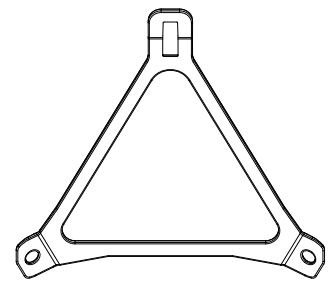
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Columns generated with this geometry form an exactly constrained, triple and co-directional, cross-linked helix.

A single, triangular, nearly planar part type assembles to form the four faces which define the 12 edges of an octahedron. The octahedra are assembled face to face; only three triangular faces are required to form each octahedron cell when placed upon the previous cell. This construction is statically and kinematically determinate following Maxwell's stability criterion; each frame consists of six joints connected by twelve bars.
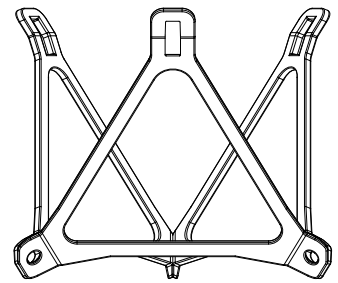
Load paths align directly at the vertices. Tension and compression both load the looped joints into one another. Pins resist separation of unloaded joints during torsion and bending moments.

Assembly of the parts follows a direct path along the centroid normal vector, allowing an elastic modulus independent assembly procedure.
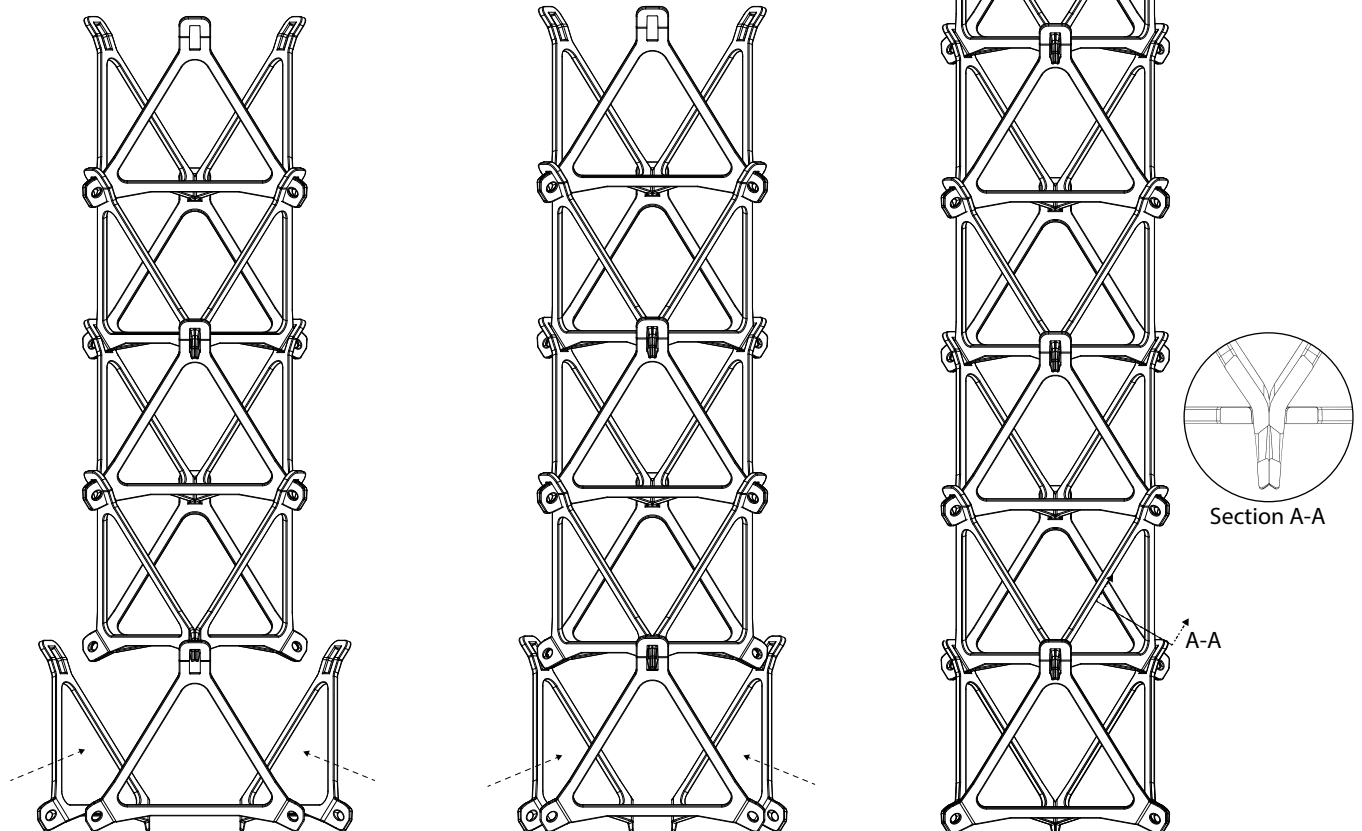
The part geometry is nearly planar with three bends; manufacture of the part is somewhat material and process independent. Sheetmetal, concrete, formed wood, composite, injection molding - all are processes capable of producing parts. The open face of the triangle is left unadulterated to allow placement of functional components depending on task requirements: skins, health monitoring, actuation, energy harvesting, etc..

Element

Cell

Section A-A

A-A

Construction-cell Motif