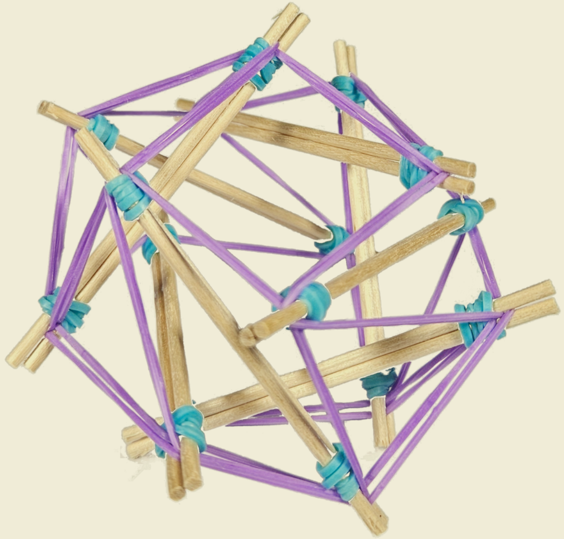
Tensegrity Polyhedra



Nick Rauh

Seattle Universal Math Museum

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JMM | 8 January 2025

Studio ∞

Tensegrity Polyhedra

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Materials

I learned this combo from **Laura Taalman** by way of **Jonah Galeota Sprung**:

2.5″ crafting mini dowels

+

Rainbow Loom rubber bands

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The module

1. Wrap each end of a pair of dowels with a band. (Winding 5-6 times is ideal for most bands.) Leave some sticking out at the ends.

2. Wrap a third band around the the two dowels, lengthwise, wedging it between them at the ends.

Tensegrity Polyhedra

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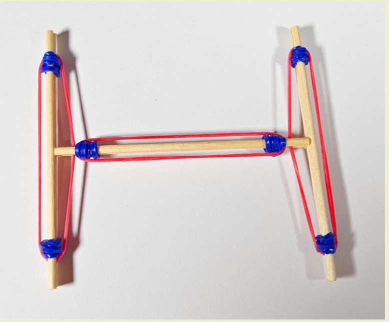
6-strut model

1



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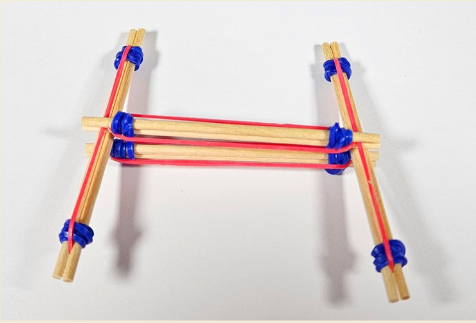

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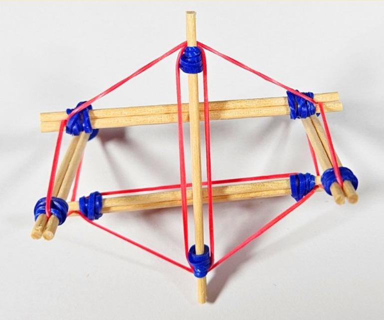

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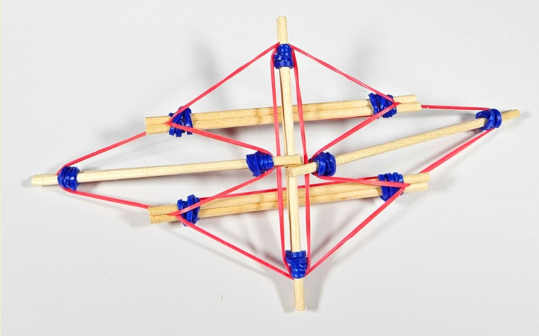

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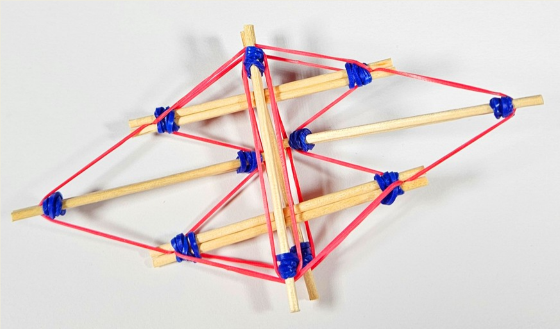

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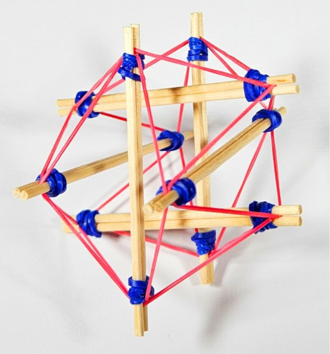

Speed-run materials

3D printed strut

+

Elastic hair band

=

Reusable tensegrity module

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Tensegrity Polyhedra

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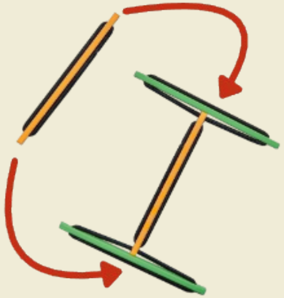
6-strut model

1



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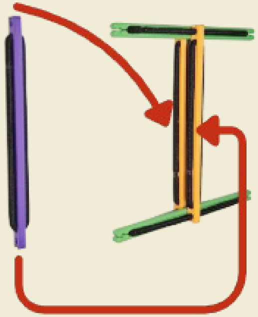

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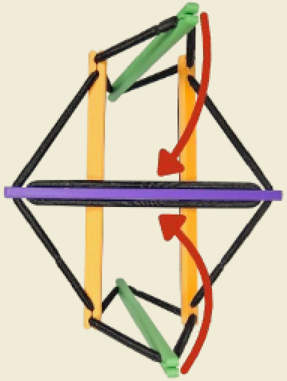

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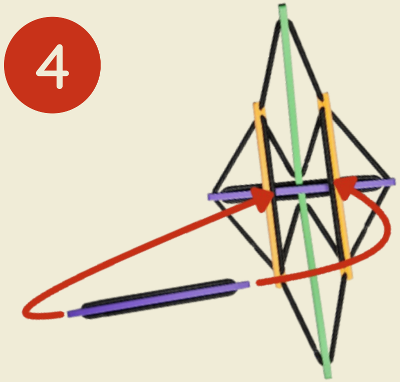

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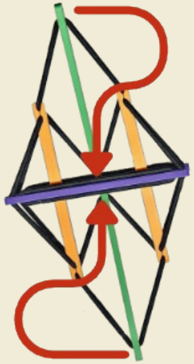

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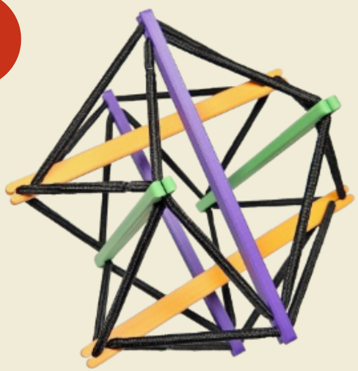
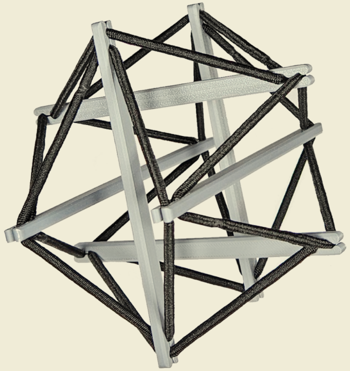
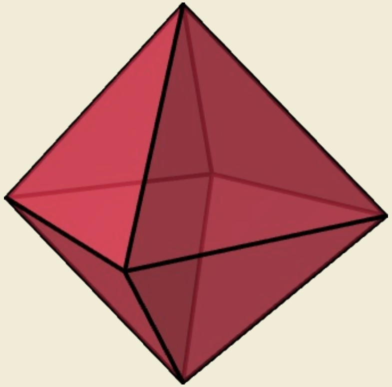


The polyhedron behind the model



6-strut model



Octahedron

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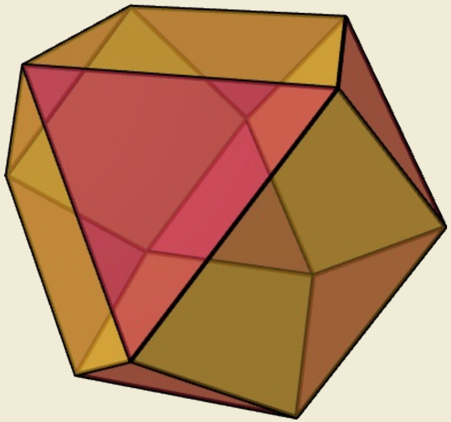
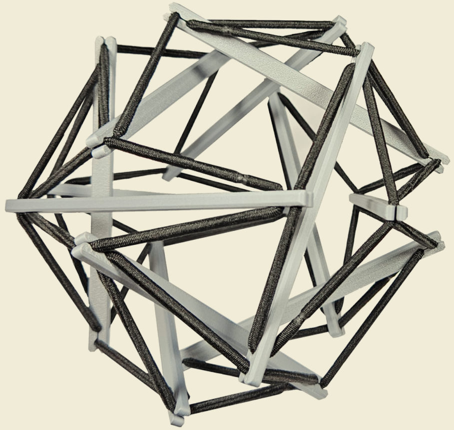
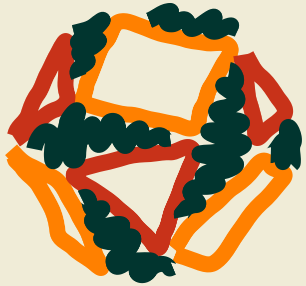
Can we target a polyhedron?



Cuboctahedron



12-strut model



Tensegrity Polyhedra

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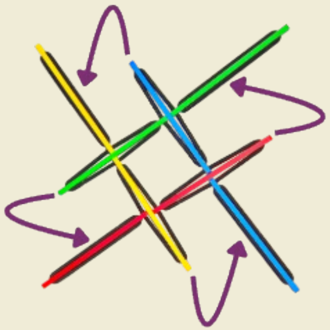
12-strut model

1

2



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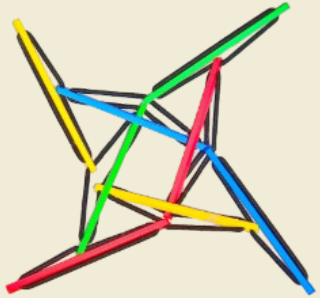

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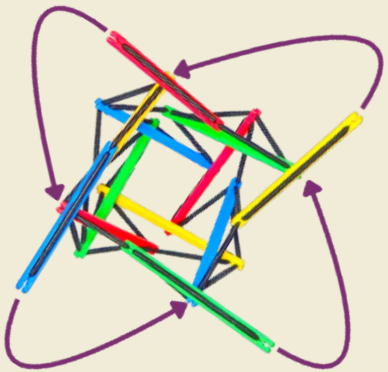

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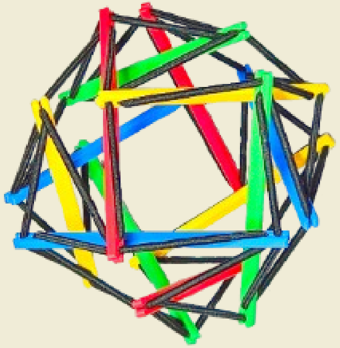

Challenge

What other structures can you make based on polyhedra?

- Do you have a framework for building?
- Can you predict the families of polyhedra your framework can build?
- Can you predict the number of modules you'll need?

Models don't have to look *exactly* like a polyhedron. Just have a convincing argument for why your model corresponds to a particular polyhedron.

Tensegrity Polyhedra

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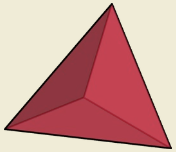
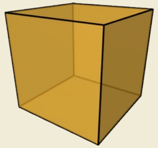
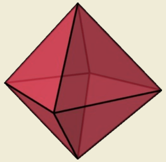
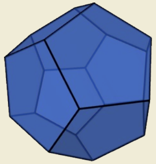
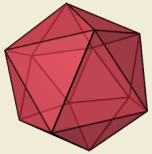
Some inspiration

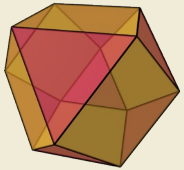

F=4,
E=6, V=4

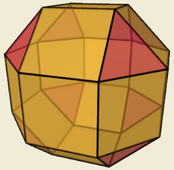

F=6,
E=12, V=8

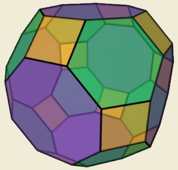

F=8,
E=12, V=6

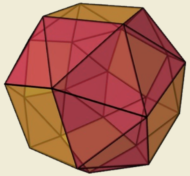

F=12,
E=30, V=20

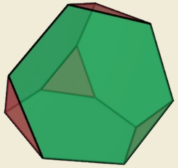

F=20,
E=30, V=12

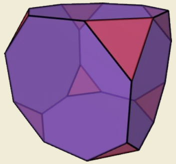

F=8+6,
E=24, V=12

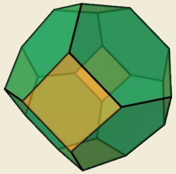

F=8+18,
E=48, V=24

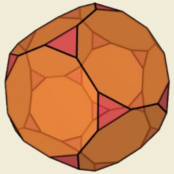

F=12+8+6,
E=72, V=48

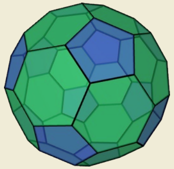

F=32+6,
E=60, V=24

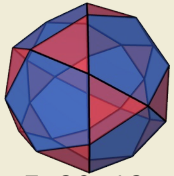

F=4+4,
E=18, V=12

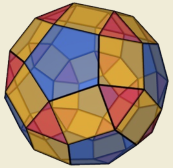

F=8+6,
E=36, V=24

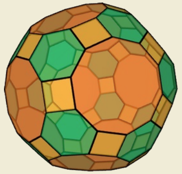

F=6+8,
E=36, V=24

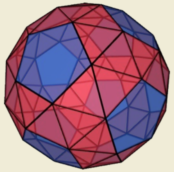

F=20+12,
E=90, V=60

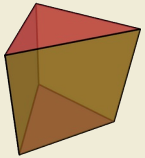

F=12+20,
E=90, V=60

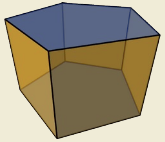

F=20+12,
E=60, V=30

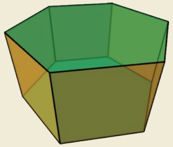

F=20+30+12,
E=120, V=60

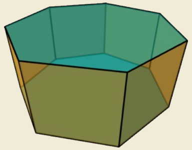

F=30+20+12,
E=180, V=120

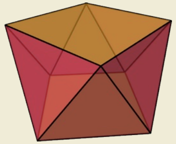

F=80+12,
E=150, V=60

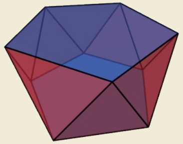

F=2+3,
E=9, V=6

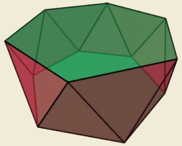

F=5+2,
E=15, V=10

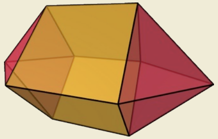

F=6+2,
E=18, V=12


F=7+2,
E=21, V=14


F=8+2,
E=16, V=8


F=10+2,
E=20, V=10

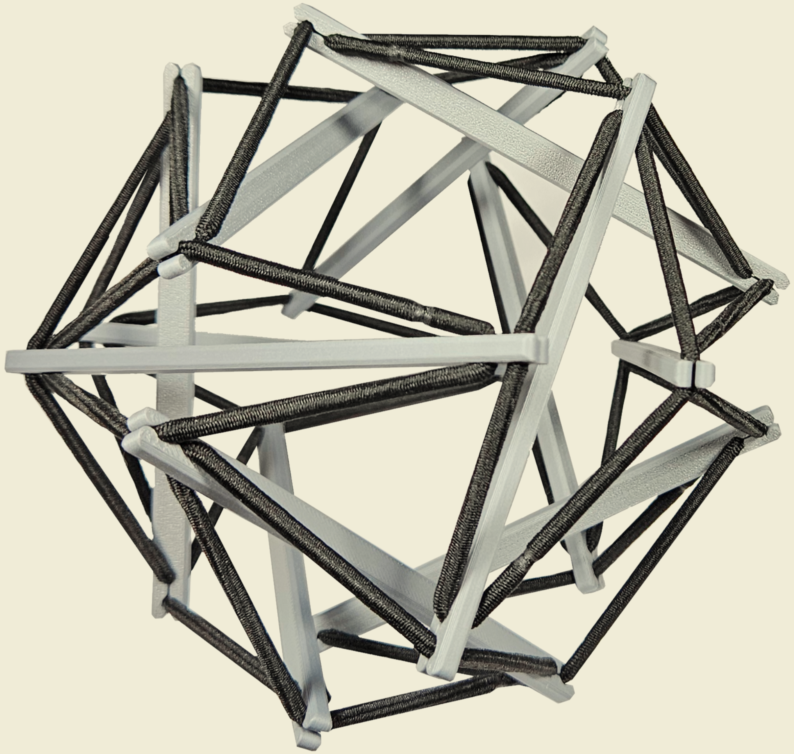

F=12+2,
E=24, V=12


F=8+4,
E=20, V=10

A Framework

Every vertex in the octahedron and cuboctahedron has degree 4.

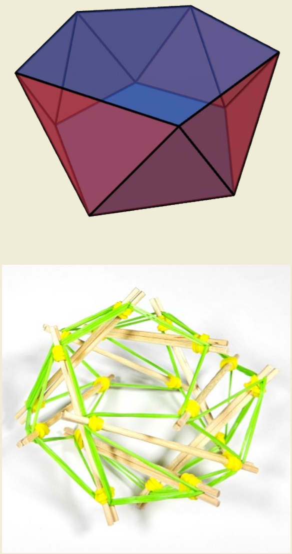
In our tensegrity models, each module forms 2 edges, so the number of modules will be E/2.



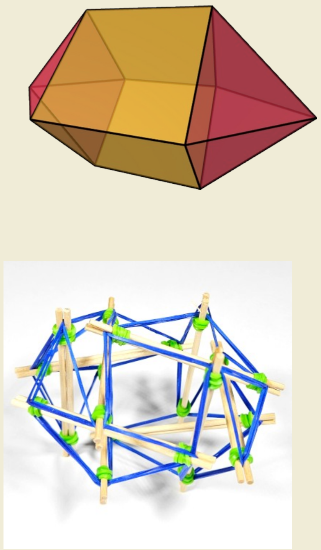
Tensegrity Polyhedra

Nick Rauh

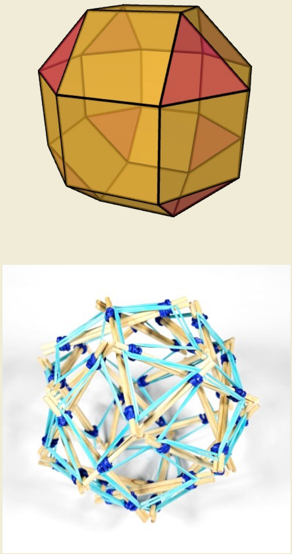
Examples



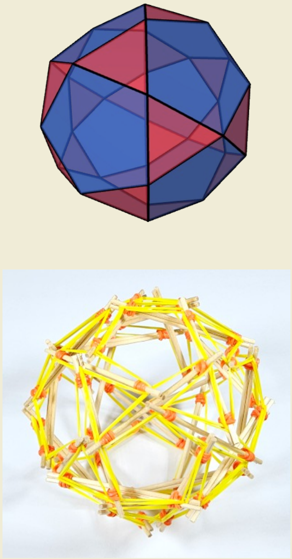
10 modules



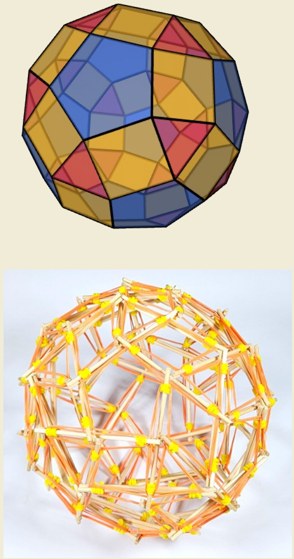
10 modules



24 modules



30 modules



60 modules

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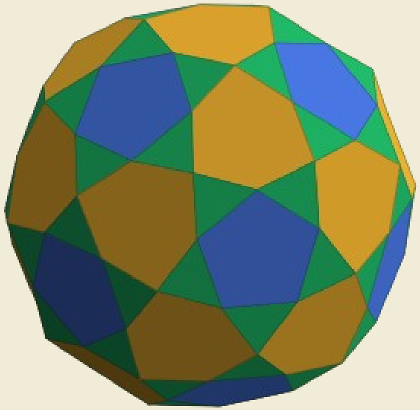
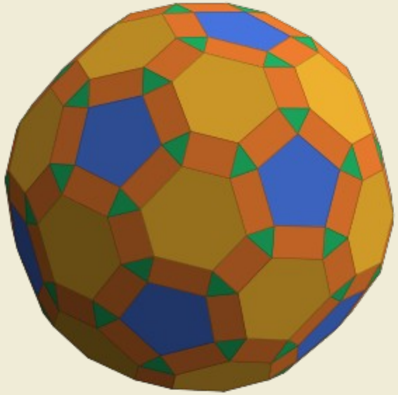
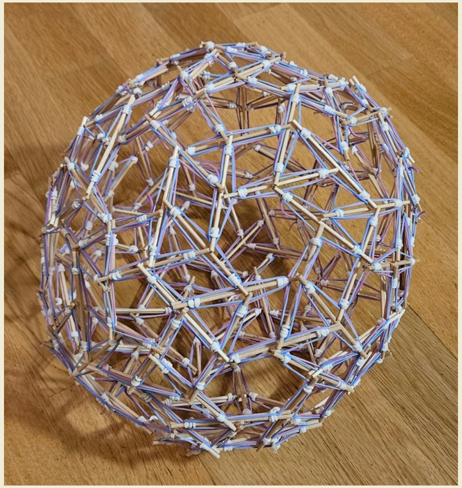
Examples





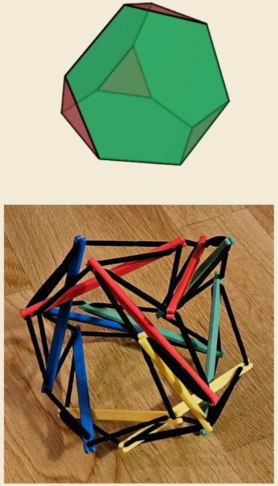


180 modules

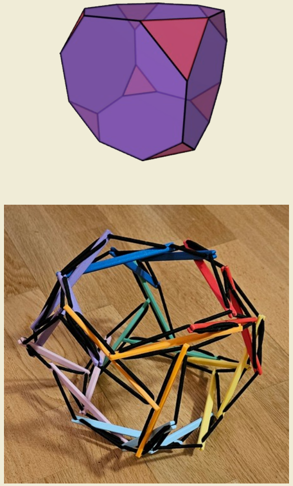
180 modules

A Tweak

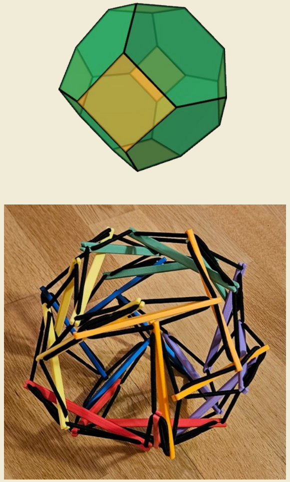
By double-linking modules, we can get degree 3 vertices!



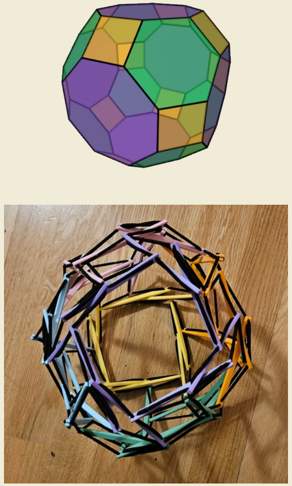
12 modules



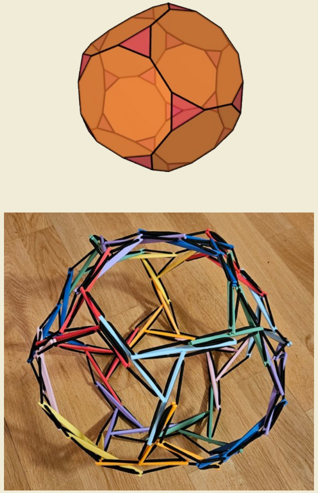
24 modules



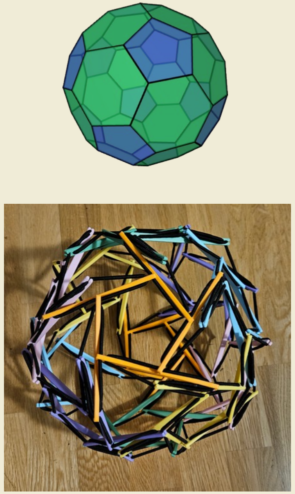
24 modules



48 modules



60 modules



60 modules

For more

https://seattlemathmuseum.org/tensegrity