

**Problems worthy of attack
prove their worth by hitting back.**

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Tensegrity Structures

Weave Tetrahedron Tensegrity Tetrahedron
Total Triangulation

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Triangulated Tension Networks

Tension/compression triangle Tension-only triangle

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Triangulated Tension Networks

A three-strut prism showing type 1, red and type 2 green triangles

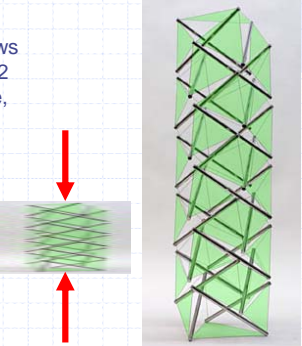
Needle Tower at the Hirshhorn Museum and Sculpture Garden in Washington, D.C.

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Triangulated Tension Networks

All tension lines -- edges, slings, draws -- are of equal length so that all type 2 triangles, colored green in the picture, are equilateral.

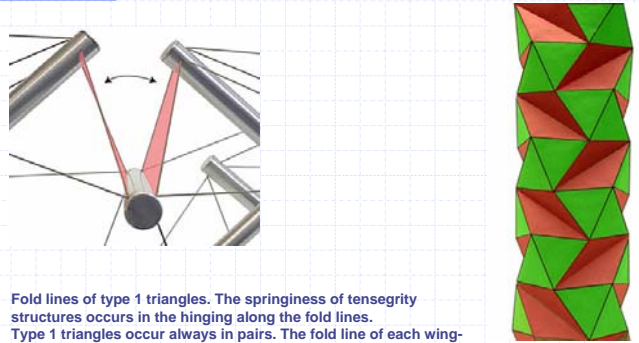
When pressed down on and released the column responds like a coiled spring.



Model of "Equilateral Quivering Tower"

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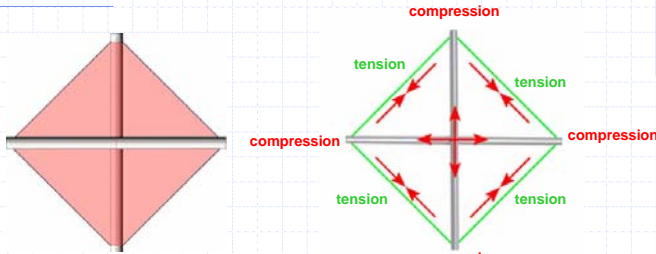
Triangulated Tension Networks



Fold lines of type 1 triangles. The springiness of tensegrity structures occurs in the hinging along the fold lines. Type 1 triangles occur always in pairs. The fold line of each wing-pair of triangles is similar to a crease in the folded-paper column to the right.

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Triangulated Tension Networks



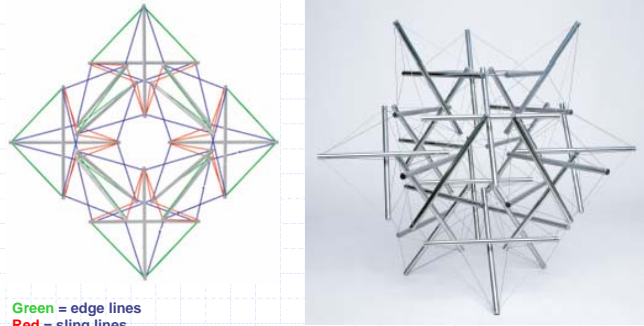
Kite frame structure with its two struts and four tension lines is composed of type 1 triangles.

Type 1 triangles occur here also in pairs making a diamond form. In the kite frame, two face-to-face diamonds share the tension lines on opposite faces of the kite.

Note that this most economical of structures is actually a flattened tetrahedron.

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Triangulated Tension Networks



Green = edge lines
Red = sling lines
Blue = draw lines

SuperStar, aluminum and stainless steel

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Sculptures

each sculpture is composed of six struts

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Sculptures

Dragon, 2000-03
stainless steel
30.5 x 31 x 12 feet
9.3 x 9.5 x 3.65m

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Sculptures

Needle Tower,
aluminum & stainless steel
60 x 20 x 20 feet
18.2 x 6 x 6m
Collection: Hirshhorn
Museum & Sculpture
Garden, Washington, D.C.

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Sculptures

Rainbow Arch, 2001
aluminum & stainless steel
7 x 12.6 x 2.6 feet
2.1 x 3.8 x 1m

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Tensegrity Patent

Feb. 16, 1965 K. D. SNELSON 3,169,611
 CONTINUOUS TENSION, DISCONTINUOUS COMPRESSION STRUCTURES
 Filed March 14, 1960 9 Sheets-Sheet 7

Fig. 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21

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Tensegrity Analysis

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Tensegrity Analysis

Tutorial Make-up Problem:
 How many storeys of identical members of 5 m steel pipes of 10" diameter and cross sectional area = 0.25 in² can be supported?
 The inclination of the struts is 7/2 (vert / hor).
 Watch that your cables carry only tensile forces!

Solution to be handed in as PPT file electronically by e-mail before Mar. 26.

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Tensegrity Roofs

Cabledome structure with rigid roof built for the **Crown Coliseum, Fayetteville, North Carolina, USA**, a 13,000 seat athletic venue.

TRUSS RING TOP CHORD
 OUTER HOOP
 OUTER DIAGONAL
 OUTER RIDGE CABLES
 MIDDLE MAST
 TRUSS RING BOTTOM CHORD
 INNER MAST
 INNER HOOP
 MIDDLE HOOP

ROOF DIAGRAM

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Tensegrity Roofs



This project demonstrates the utility of tensegrity-type domes in structures where tensile membrane roofs may not be appropriate or economical.



Arrgggh, it's over!



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Life is too short to sail a slow boat.