Tensegrity Bamboo Architecture

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Tensegrity

" All structures, properly understood, from the solar system to the atom are tensegrity structures " (Fuller , 1975).

Tensegrity, tensional integrity or floating compression, is a structural principle based on the use of isolated components in compression inside a net of continuous tension, in such a way that the compressed members (usually bars or struts) do not touch each other and the prestressed tensioned members (usually cables or tendons) delineate the system spatially.

(Photo .1)

photo .1

Theme: Architecture, Engineering and Social Housing

The advantages of this architecture are:

• Safe
• Sustainable
• Ephemeral
• Easy and quick assembly.
• Ecological
• Dynamic
• Aseismic
• Lightweight
• Optimal Structural behavior

The following work was done in México at the Autonomous University of Puebla by Arq. Martin Abdi (2010).
Mount two hours with prefabricated modules. (Photo 1)

photo 2

Theme: Architecture, Engineering and Social Housing

Icosahedral module by Arq. Martin Abdi (2010). (Photo 2 , photo 3)

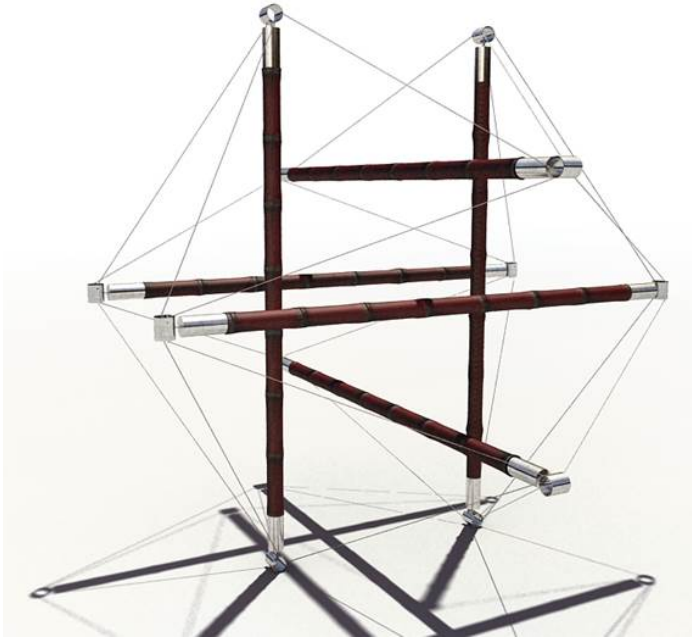

photo 2

photo 3

Theme: Architecture, Engineering and Social Housing

Material gives the impression of floating (Photo 4, photo 5)

photo 4

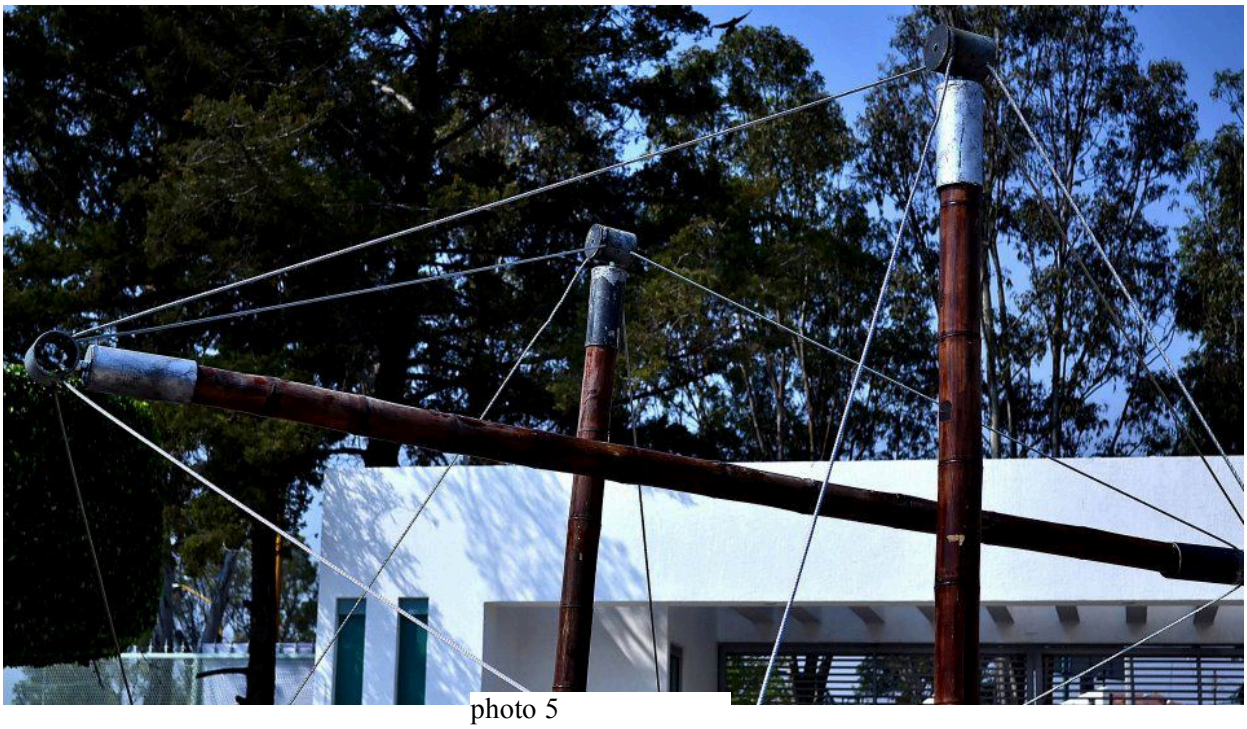

photo 5

Theme: Architecture, Engineering and Social Housing

Finished structure (Photo 6) and proposal cover (Photo 7)

photo 6

photo 7

Theme: Architecture, Engineering and Social Housing

Structure Models held in University of Camaguey Cuba by Arq. Martin Abdi (2011) (Photo 8, photo 9, photo 10)

photo 8

photo 9 and 10

Theme: Architecture, Engineering and Social Housing

Design process by Arq. Martín Abdi:

Step 1 (fig. 1) :

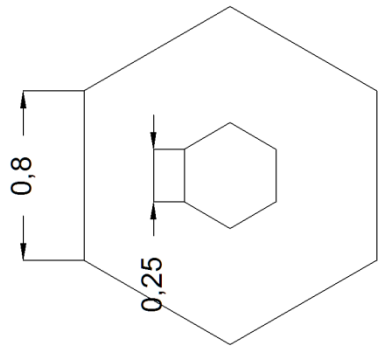

Fig. 1

Step 2 (fig. 2):

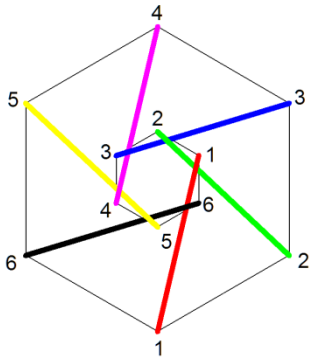

Fig. 2

Step 3 (fig. 3):

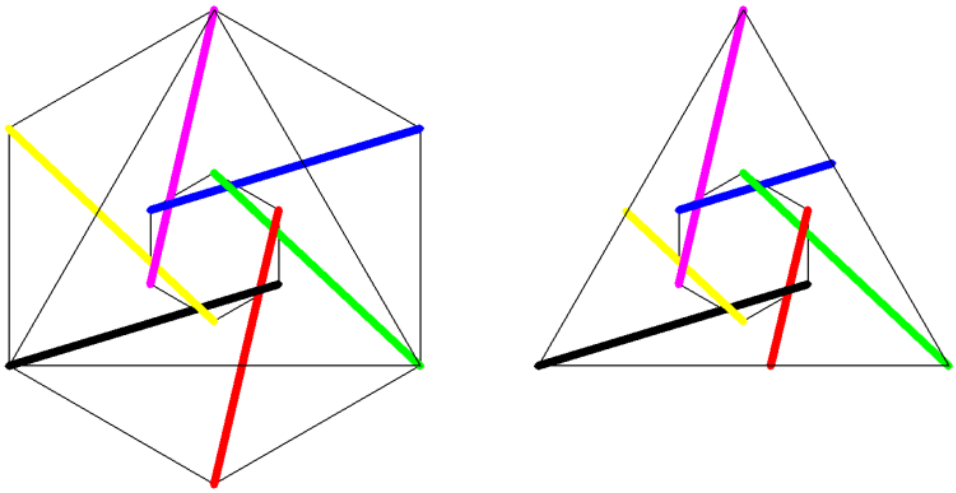

Fig. 3

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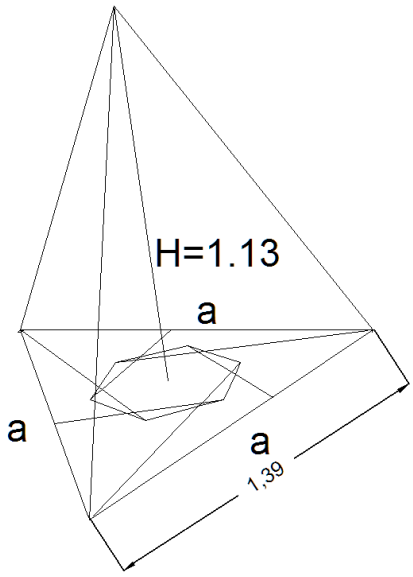
Step 4 (fig. 4):



$$H = \frac{a\sqrt{6}}{3}$$

$$H = \frac{1{,}39\sqrt{6}}{3} \qquad H = 1{,}13m$$

Fig. 4

Step 5 (fig. 5):

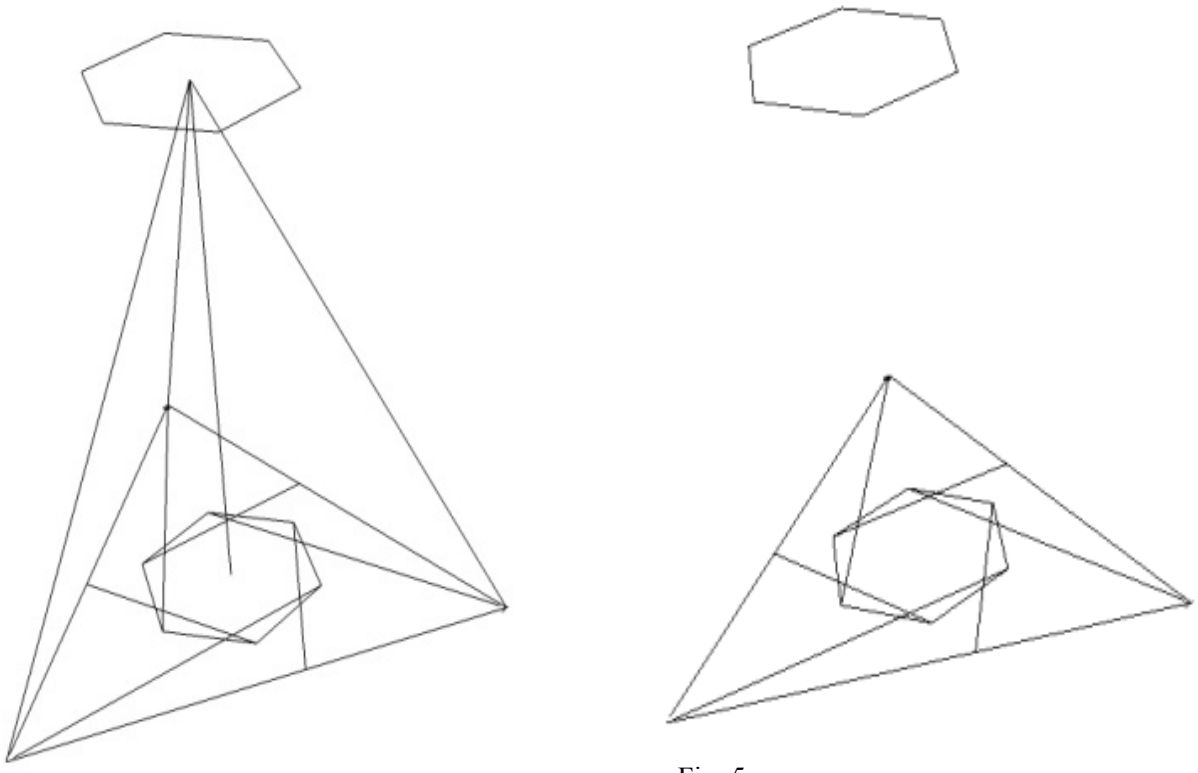


Fig. 5

Step 6 (fig. 6):

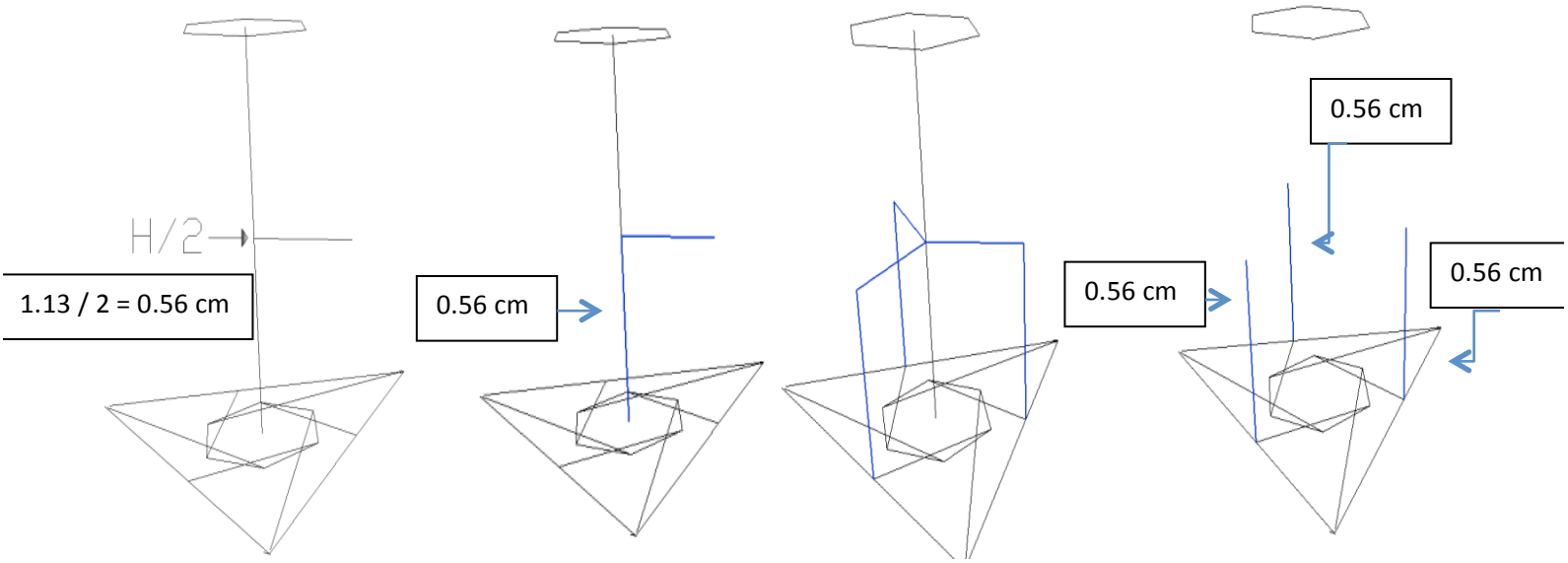


Fig. 6

Step 7(fig. 7):

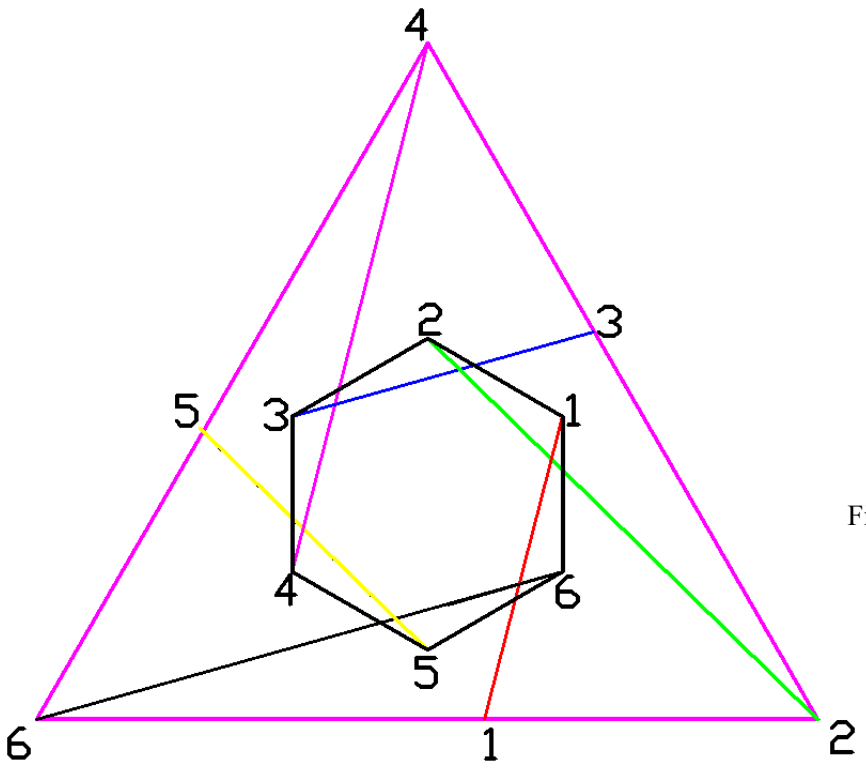


Fig. 7

Step 8 (fig. 8):

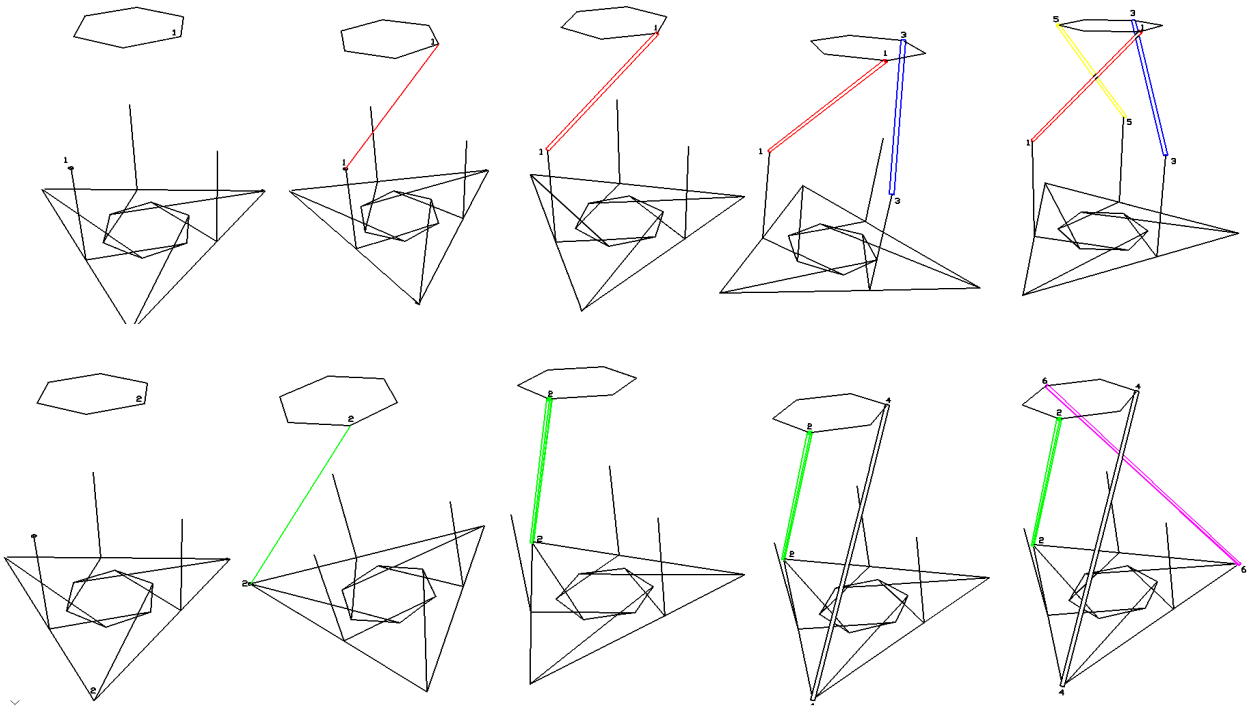


Fig. 8

Step 9 (fig. 9):

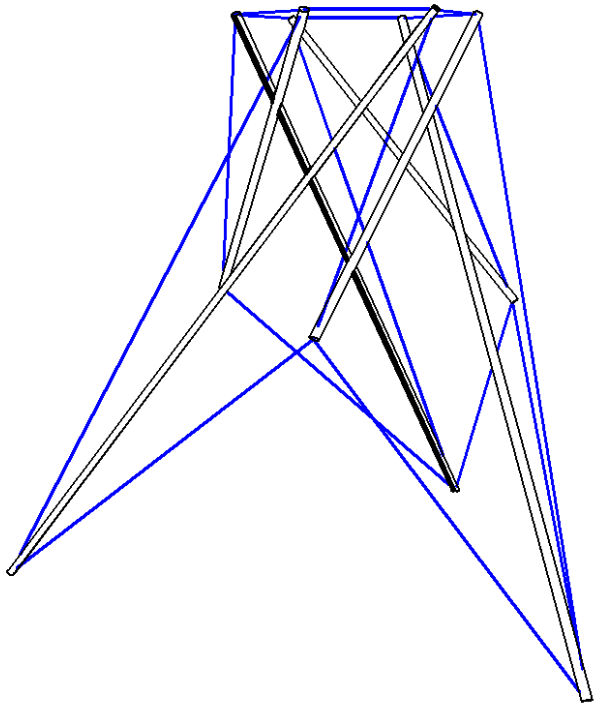


Fig. 9

The union and the structural model by Arq. Martin Abdi (Photo 11, Photo 12)

Photo 11

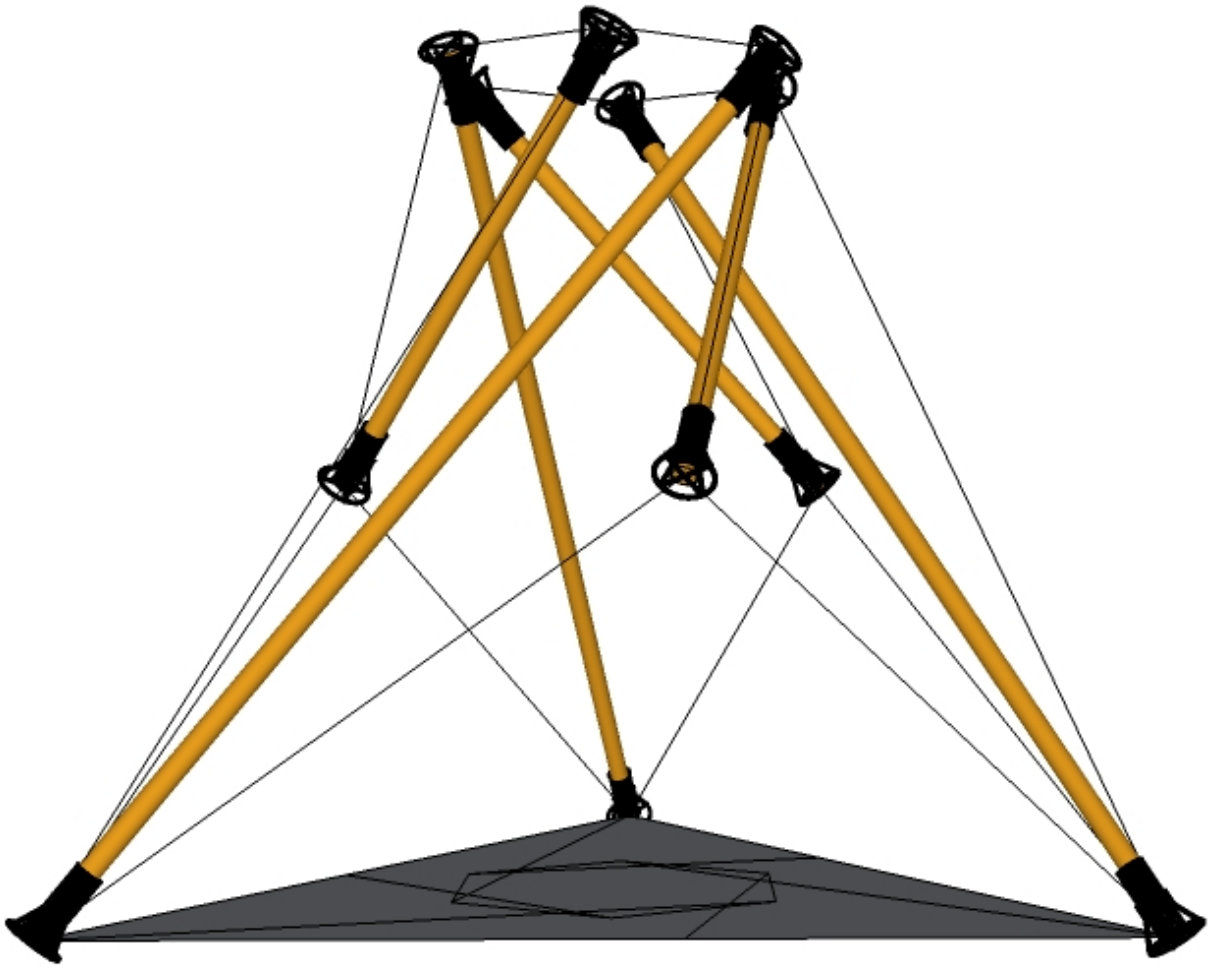


Photo 12

Construction of structural model (Photo 13, figure 10, photo 15, photo16)

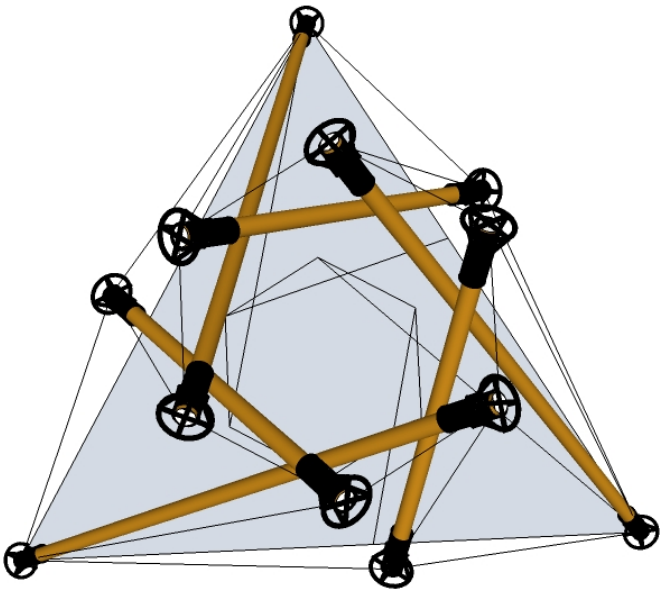


Photo 13

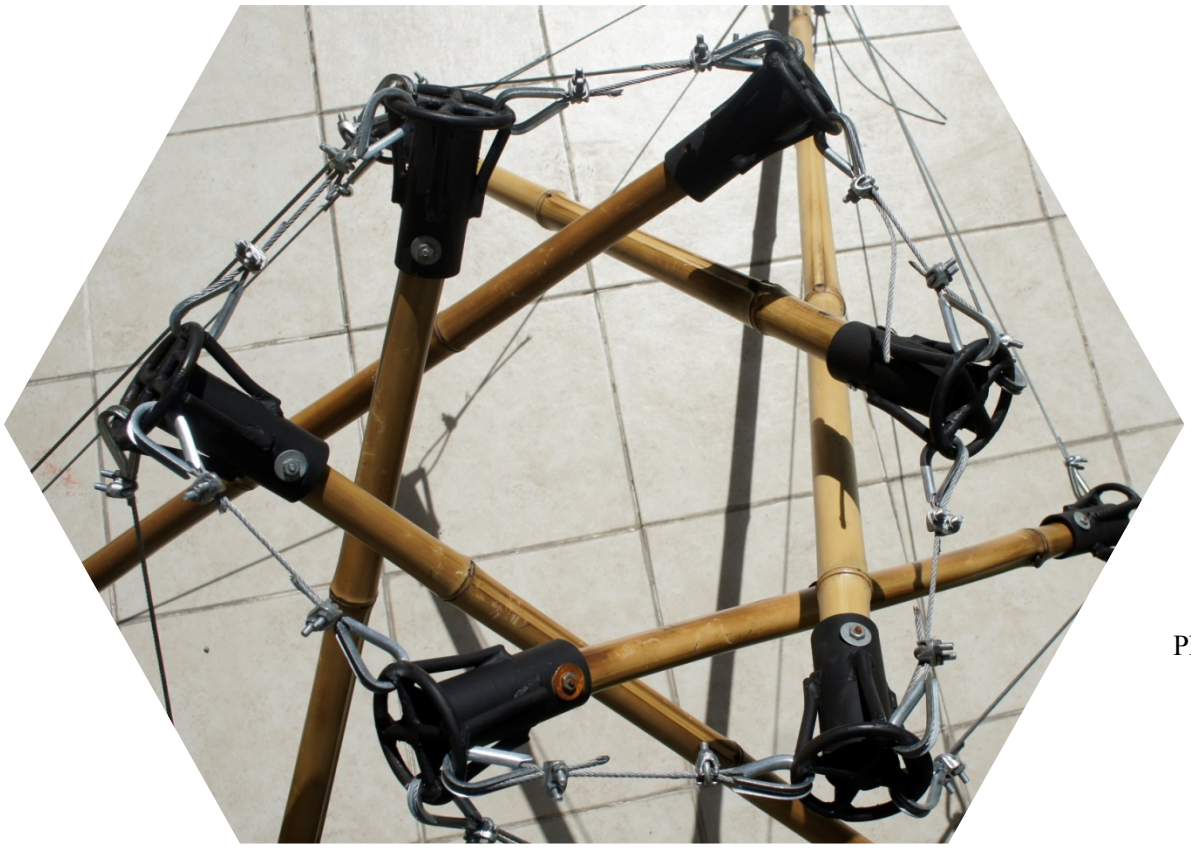


Photo 14

Photo 15

Theme: Architecture, Engineering and Social Housing

Construction of the proposed design by Arq. Martin Abdi (Photo 17, photo 18, photo 19, photo 20)

Photo 17

Photo 18

Photo 19

Theme: Architecture, Engineering and Social Housing

Proposals cover by Arq. Martin Abdi (Figure 11, 12,13,14,15,16,17 and 18)

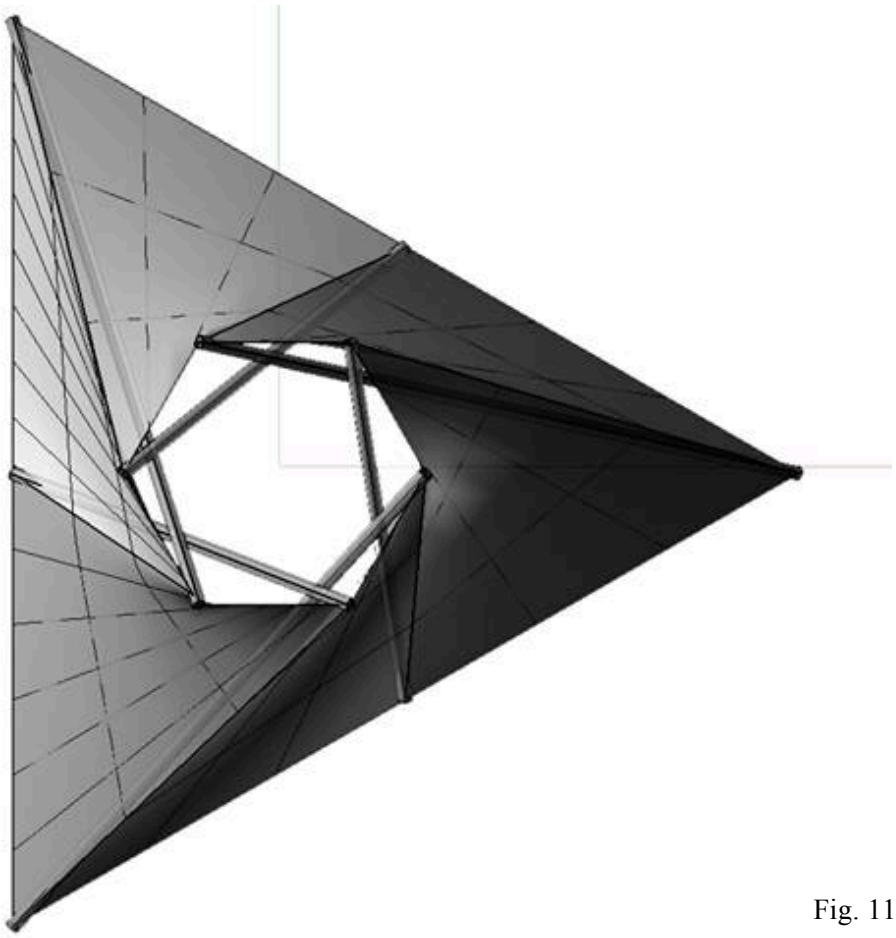


Fig. 11

Fig. 12

Fig. 13

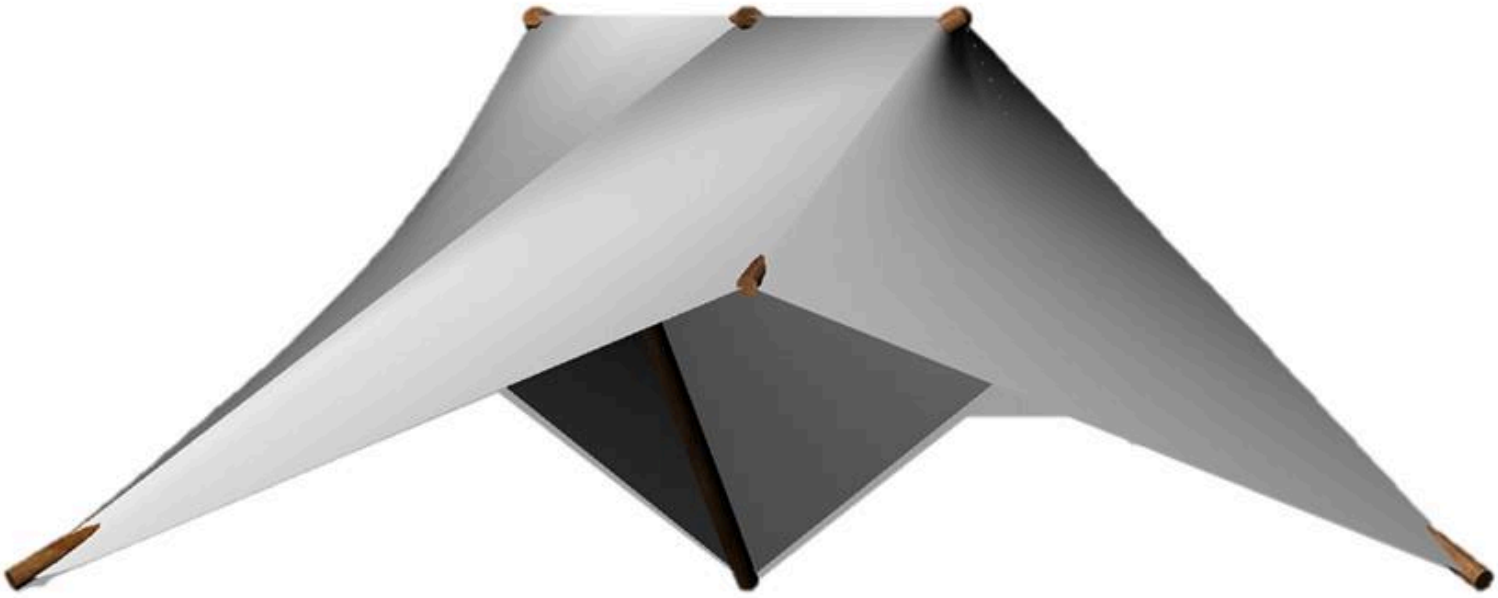


Fig. 14

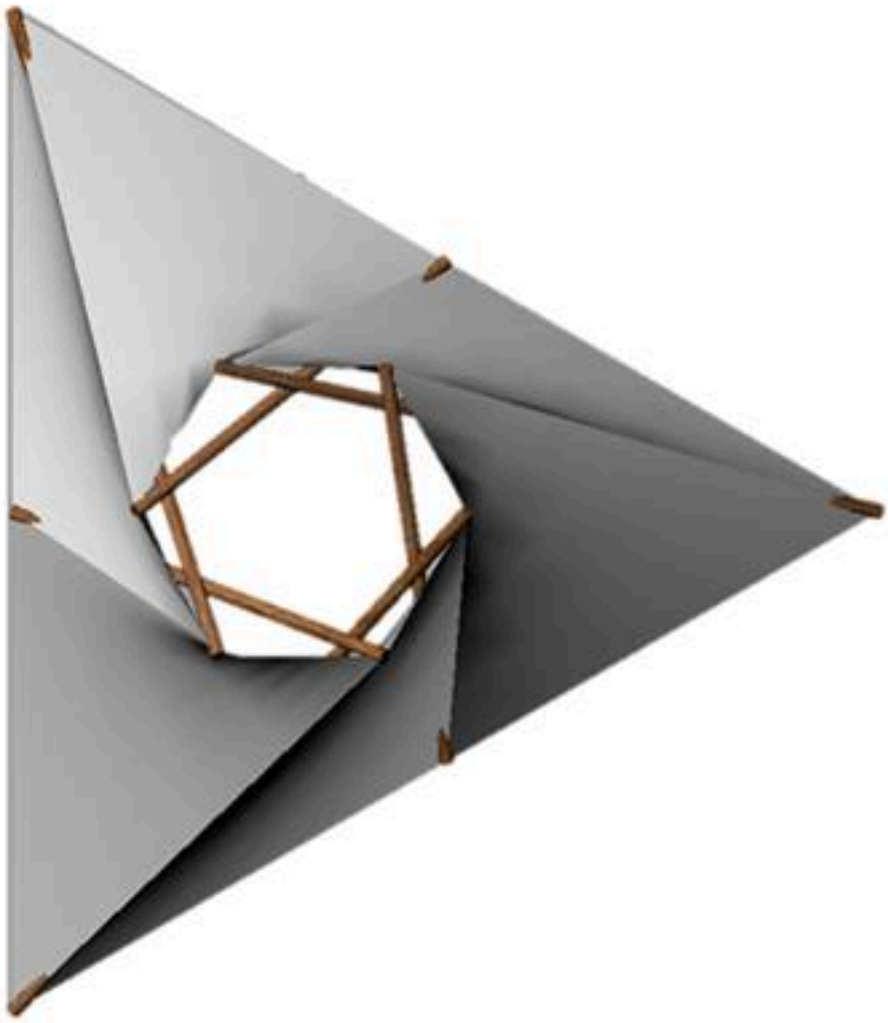


Fig. 15

Fig. 16

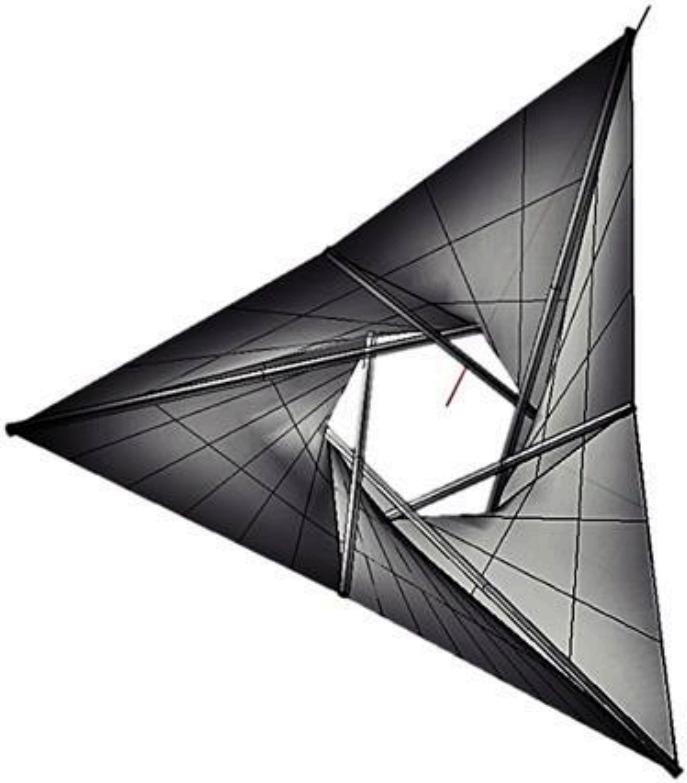


Fig. 17

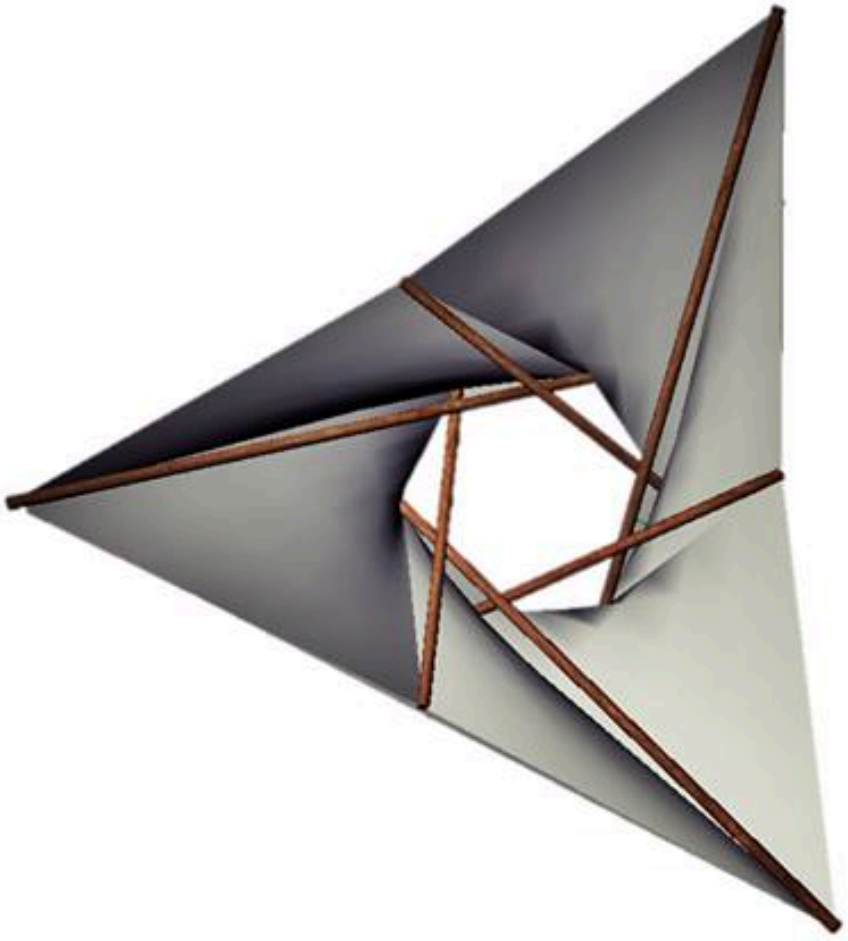


Fig. 18

Fig. 19

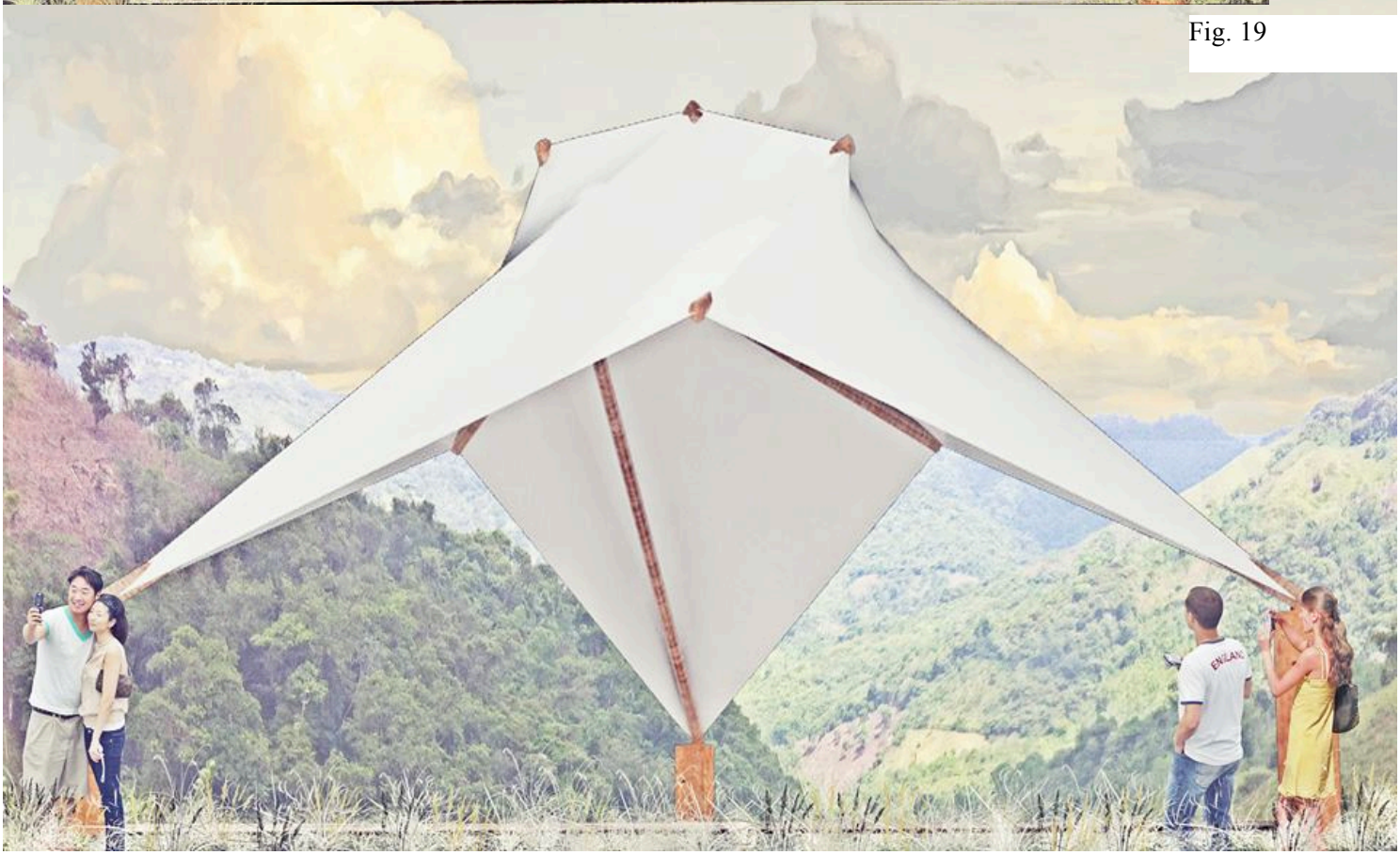
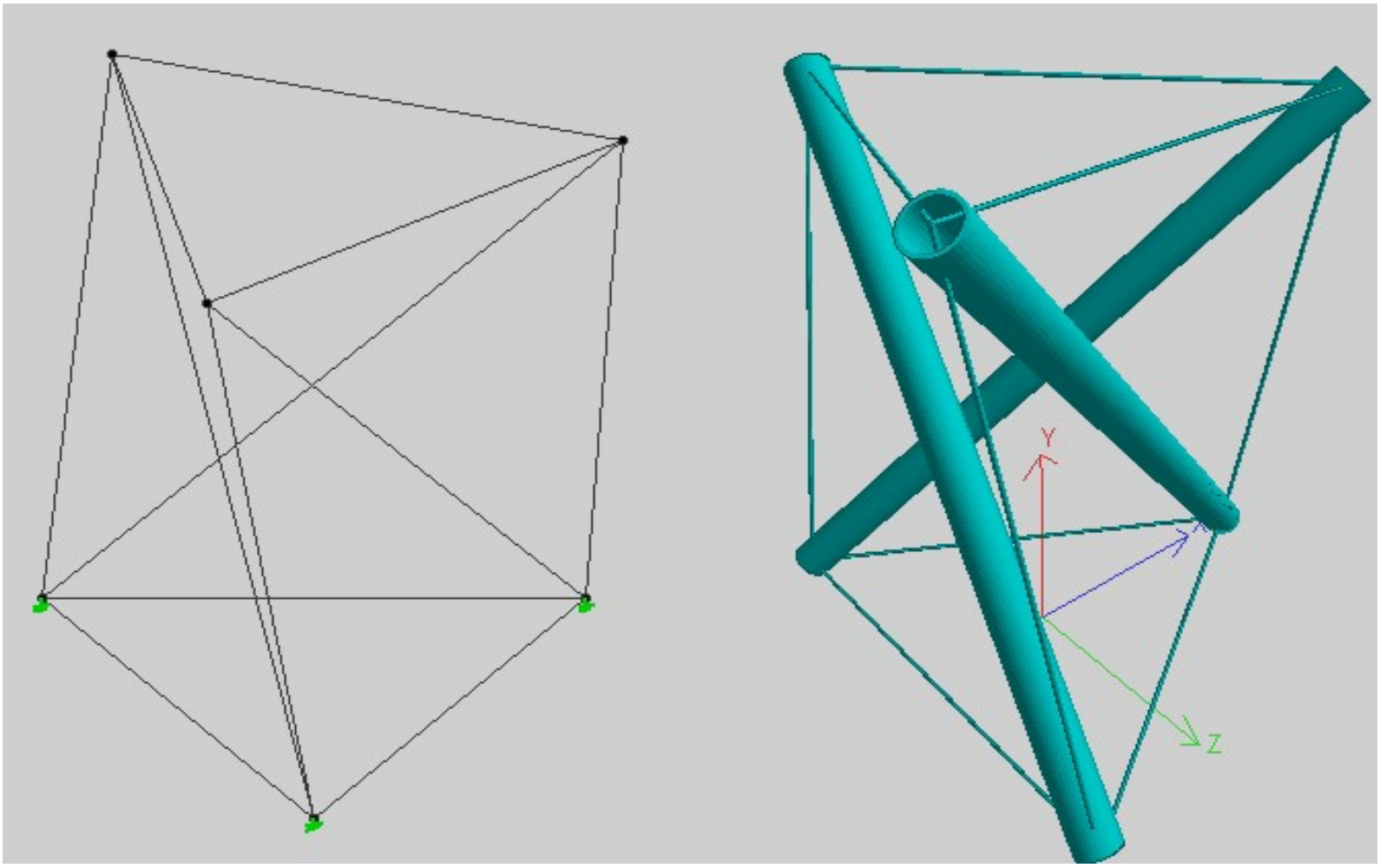


Fig. 20

Summaries in models and results

General Considerations**:**
This summary shows two of the models analyzed by Dr Noel IIraola of Camaguey Cuba with some results from the stress-strain point of view. In the same way forward in modeling such structures is shown. The models can be adjusted to the extent that progress in the investigations of geometry and the inherent physical-mechanical materials the elements of the model property values are adjusted. This calibration process of theoretical models can be done by comparing with real models built on a reduced scale. This analysis may result in the possibility of using the theoretical model types spring elements, or tensioning cables.

Type Model 1
Views of the model geometry (fig 21)



Views deformed geometry model (Enlarged displacement fig 22)

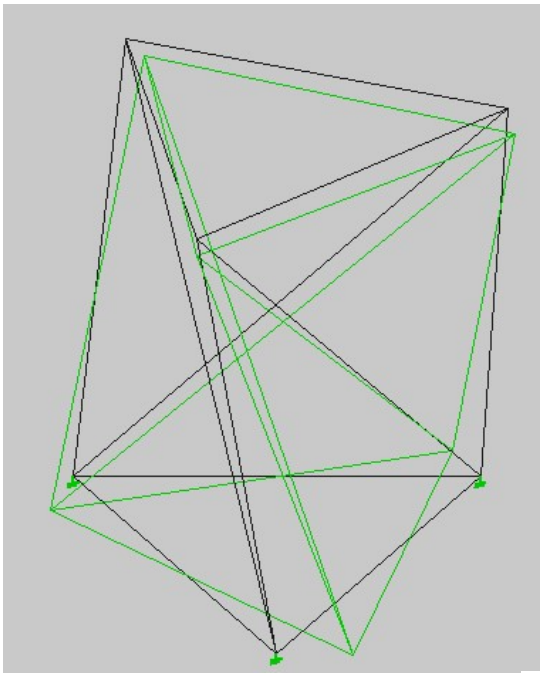


Fig. 22

Chart axial stresses in the elements. (Fig 23.)

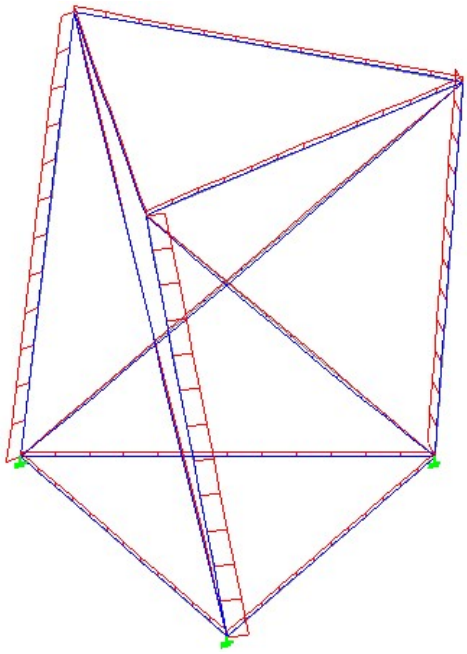


Fig. 23

Displacement values at the nodes (Table 1)

Node	L/C	X-Trans mm	Y-Trans mm	Z-Trans mm	Absolute mm	X-Rotan rad	Y-Rotan rad	Z-Rotan rad
3	1	1.376	0.000	0.877	1.632	-0.001	0.000	0.001
2	1	-1.133	0.000	0.988	1.503	-0.001	0.000	-0.001
1	1	0.026	0.000	-1.239	1.240	0.001	0.000	0.000
4	1	-0.044	-0.420	0.389	0.574	-0.001	-0.000	-0.001
5	1	0.313	-0.420	0.234	0.573	-0.001	-0.000	0.001
6	1	0.000	-0.420	0.003	0.420	0.001	0.000	-0.000

Table.1.

Structure2 - Beam End Force

Beam	L/C	Node	Axial Force kN	Shear-Y kN	Shear-Z kN	Torsion kNm	Moment-Y kNm	Moment-Z kNm
9	1	5	0.044	0.012	-0.000	-0.000	-0.000	-0.000
7	1	4	0.044	0.012	-0.000	0.000	0.000	-0.000
8	1	6	0.044	0.012	-0.000	0.000	-0.000	-0.000
10	1	2	0.044	0.000	0.000	0.000	0.000	0.000
11	1	6	0.042	0.000	0.000	0.000	0.000	0.000
12	1	4	0.042	0.000	0.000	0.000	0.000	0.000
15	1	4	0.011	0.001	0.000	0.000	0.000	0.000
13	1	5	0.011	0.001	0.000	0.000	0.000	0.000
14	1	6	0.011	0.001	0.000	0.000	0.000	0.000
2	1	2	0.011	0.001	0.000	0.000	0.000	0.000
3	1	3	0.011	0.001	0.000	0.000	0.000	0.000
1	1	1	0.011	0.001	0.000	0.000	0.000	0.000
1	1	2	-0.011	0.001	0.000	0.000	0.000	0.000
3	1	1	-0.011	0.001	0.000	0.000	0.000	0.000
2	1	3	-0.011	0.001	0.000	0.000	0.000	0.000
14	1	4	-0.011	0.001	0.000	0.000	0.000	0.000
13	1	6	-0.011	0.001	0.000	0.000	0.000	0.000
15	1	5	-0.011	0.001	0.000	0.000	0.000	0.000
7	1	2	-0.018	0.012	0.000	-0.000	0.000	0.000
8	1	1	-0.018	0.012	0.000	-0.000	-0.000	0.000
9	1	3	-0.018	0.012	0.000	0.000	-0.000	0.000
10	1	5	-0.042	0.000	0.000	0.000	0.000	0.000
11	1	3	-0.044	0.000	0.000	0.000	0.000	0.000
12	1	1	-0.044	0.000	0.000	0.000	0.000	0.000

Stress values in the elements (Table 2).

Table 2.

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Type Model 2
Views of the model geometry (fig 24)

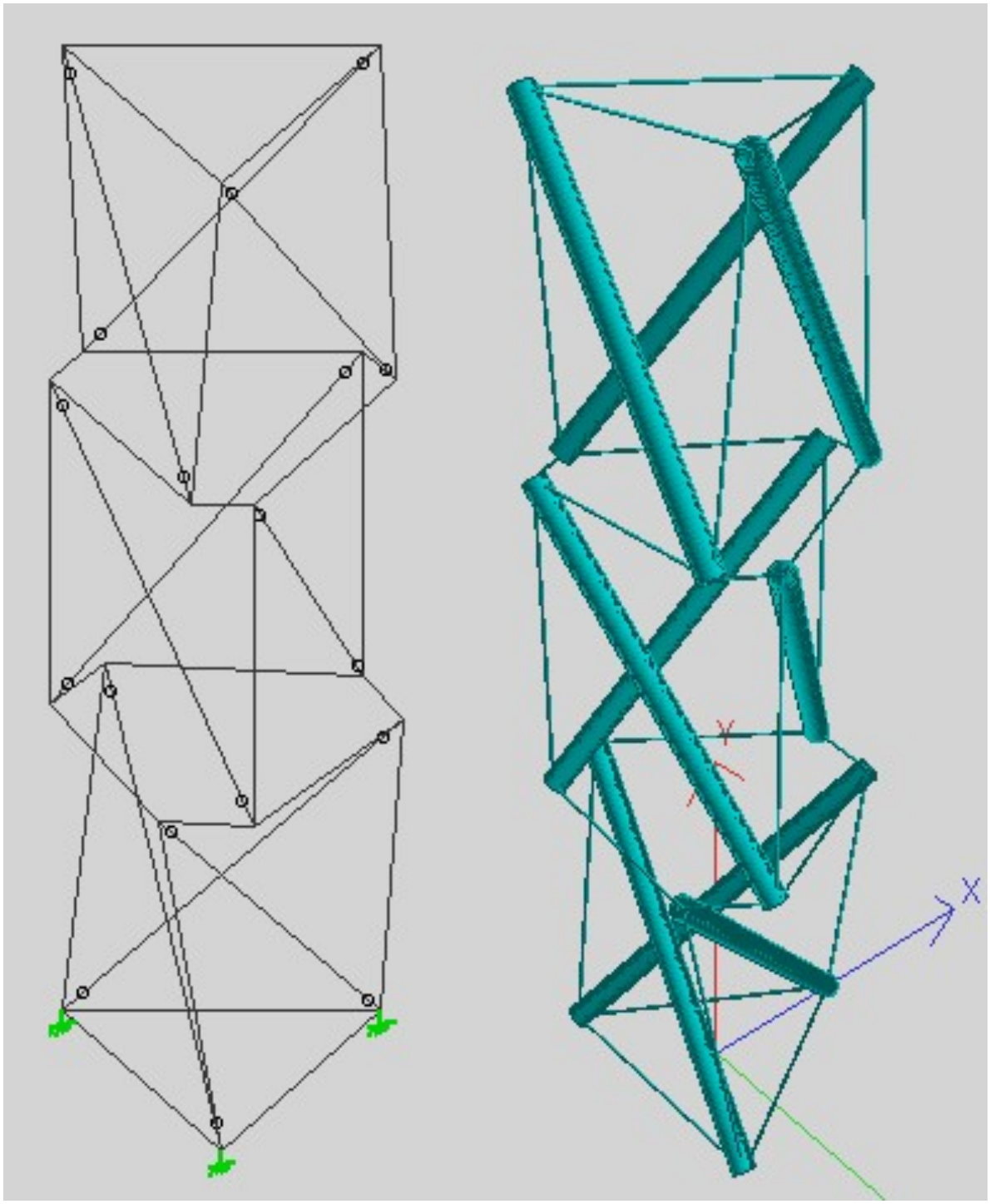


Fig. 24

Views deformed geometry model
(Enlarged displacement fig. 25.)

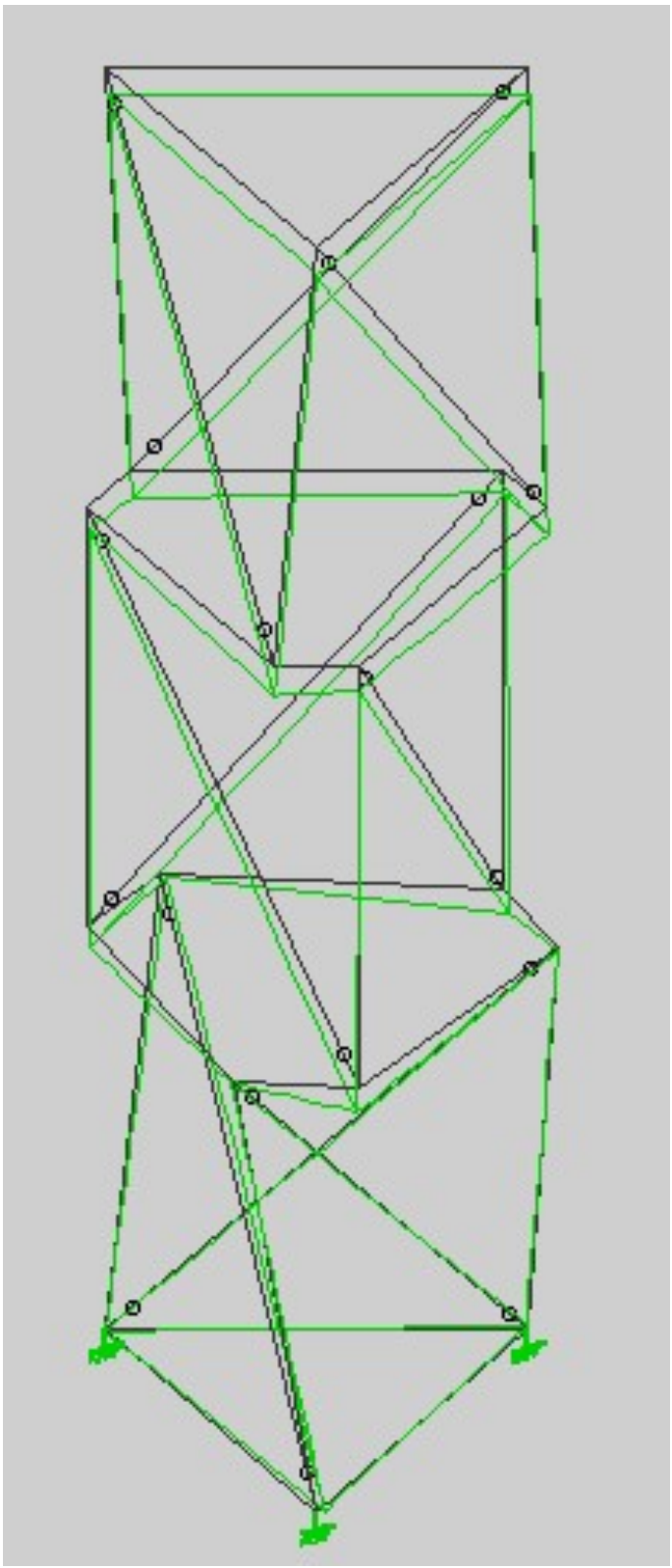
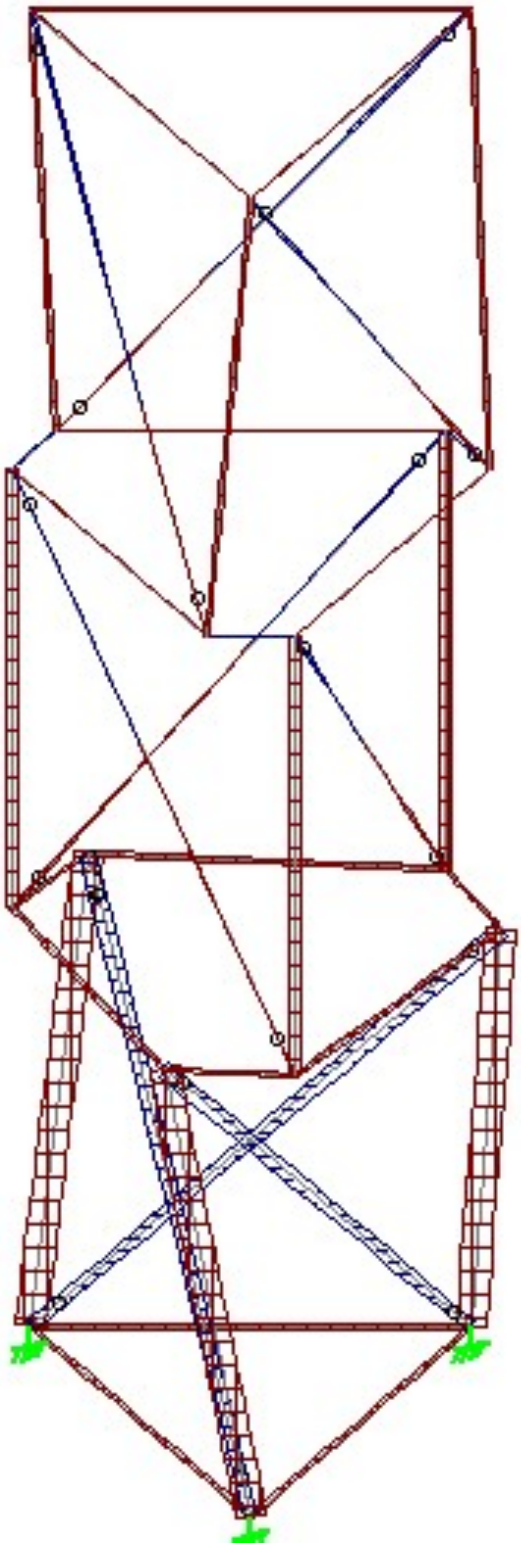


Chart axial stresses in the elements
(fig.26.)



Tensegrity Bamboo Architecture

It is done with the aim of showing a structure and space ecological, ephemeral, organic, innovative, clear, easy assembly, easy transportation, Lightweight structure, among other values to be recreational spaces between other various chores.

At present there is real demand for opting for alternative elements in materials and construction systems, so it is plausible to propose structural systems operating independently, they are inexpensive to mount and innovative show that structurally. Operate without the need for foundations and elements which are subject purely tensile and compression are then talking about a tensegrity structure. (Leonardo, 1992) Fitting a tensegrity structure with bamboo then it is an interesting combination to propose innovative experimental designs and also with economic and sustainable basis.

Bibliographies

Biagio Di Carlo (October 2012) Tensegrity world, Martin Aguilar Abdi Mortera, DC Books Pescara Italy, pp, 210-212 (3)

Hoyos M., Juan M. (2009). *Las estructuras de Tensegrity. Colección punto aparte.pp,11*

Theme: Architecture, Engineering and Social Housing