Tensegrity: Geodesic Domes

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Introduction

Geodesic domes are lightweight, spacious, strong and beautiful structures. They use the least amount of material to encapsulate the maximum volume of space. Their geometry makes them strong and suitable for many applications requiring quick and cheap erection and at the same time providing a safe shelter. The design of these structures was pioneered by the American engineer Buckminster Fuller in 1954 who took his inspiration from natural forms [1].

Concept

Fuller named the structural principle behind these structures as **tensegrity [1]** (tensional and integrity), which means that the loads are resisted by a combination of tension and/or compression of the members. This makes the strength of the structure dependant on the cross section of individual members and/or their resistance to buckling. The load is efficiently transferred through the members to the foundations.

Nagoya Dome [4]

Strength

These types of structures can take spherical or semis spherical forms and are usually composed of pinned connected struts in triangular or hexagonal meshes. Triangular shapes are considered to be structurally the most efficient of the plane geometrical figures [1]. They provide a short load path and an even distribution of forces through the structure.

Visual appearance

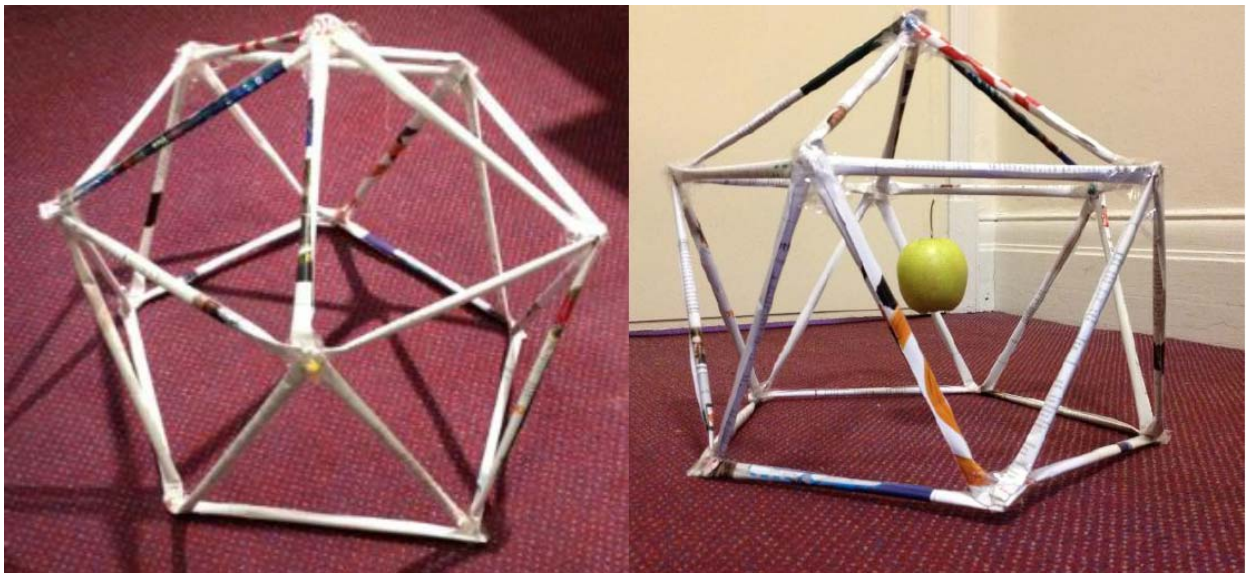
Domes are visually attracting due to their unconventional form. Because they are self supporting, there is no need for columns or load bearing walls inside the dome. That creates an unobstructed view of the whole structure.

The Long Island Green Dome [1]

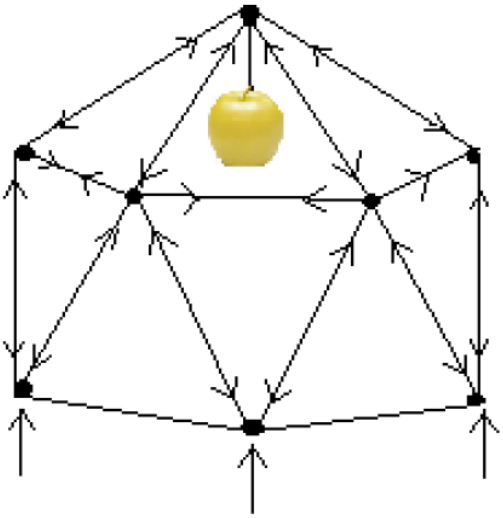
Applications

Due to their spacious, rigid structure and low quantity of materials geo domes can be used for shelter in many different climates especially where resources are scarce. In Antarctica they have been used for military radar systems and resisted winds of around 200 miles per hour. They've been also used for churches, concert halls, circuses, planetariums, theatres and arenas [1, 5].

Model



The model consists of wrapped magazine pages of equal size (which are quite good in tension but susceptible to buckling). The members were pinned at each end, forming equilateral triangles.



Vertical and horizontal forces are distributed to the foundations through the members in tension or compression.

The joint connections must be strong enough to resist stresses from the members. At each joint, the sum of the member forces should be zero in all three dimensions.

1. Nathan Chandler. 2010. *How Geodesic Domes Work*. [ONLINE] Available at:http://science.howstuffworks.com/engineering/structural/geodesic-dome1.htm. [Accessed 17 February 13].
2. About.com. 2010. *1954 - Present: Geodesic Dome*. [ONLINE] Available at:http://architecture.about.com/od/periodsstyles/ig/House-Styles/Geodesic-Dome.htm. [Accessed 17 February 13].
3. Domes.to. 2006. *Domes*. [ONLINE] Available at: http://www.domes.to/domes.html. [Accessed 17 February 13].
4. Wikipedia. 2012. *Nagoya Dome*. [ONLINE] Available at: http://en.wikipedia.org/wiki/Nagoya_Dome.
5.. *What Are Geodesic Domes Used for?*.:http://www.ehow.com/list_6453448_geodesic-domes-used-for_.html.