Unique Properties of the Geodesic Dome

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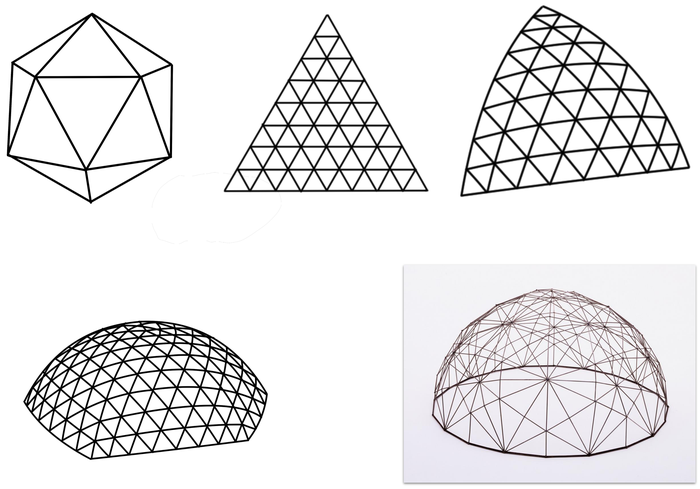
1 Abstract

- Among structures, domes carry the distinction of containing a maximum amount of volume with the minimum amount of material required. Geodesic domes are a twentieth century development, in which the members of the thin shell forming the dome are equilateral triangles.
- This union of the sphere and the triangle produces numerous benefits with regards to strength, durability, efficiency, and sustainability of the structure. However, the original desire for widespread residential, commercial, and industrial use was hindered by other practical and aesthetic considerations

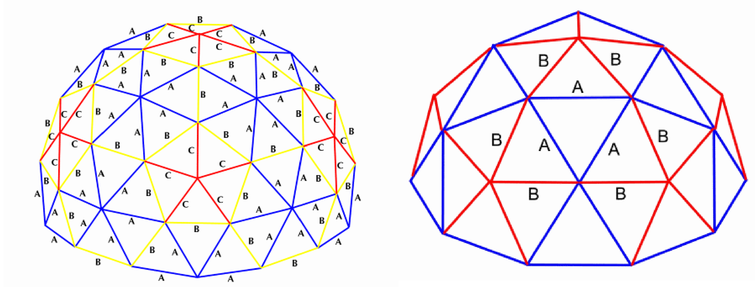
2 Background

- Pattern of pyramids projected off platonic polyhedron
- Pattern is commonly projected off icosahedron
- geodesic domes are created from a polyhedron with a rounded surface
- Members are in tension, and compression, instead of compression exclusively



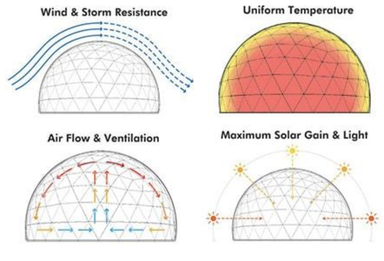
3 Benefits

- Consider the dome in comparison to a rectangular structure of equal height:
- Geodesic domes are exceedingly strong when considering both vertical and wind load
  - 25% greater vertical load capacity
  - 34% greater shear load capacity
- Domes are characterized by their “frequency”, the number of struts between pentagonal sections
  - Increasing the frequency of the dome closer approximates a sphere



Frequency (v) 3 and 2 geodesic domes (Ziptie Domes)

- The closer the dome approximates a sphere, the better the volume to surface area ratio
  - 30% improvement for v > 2
  - Requires less material to construct than traditional structures
- Spherical shape and low surface area increase energy efficiency significantly
  - Natural convection forces heat to circulate, maintaining a constant temperature
  - Up to 30% energy savings for heating and cooling
  - Maximum solar light and energy absorption
- Most earthquake resistant structure available
  - Without the use of vertical supports reducing volume



(Biodomes.eu)

4 Drawbacks

- Domes are unable to be partitioned effectively into rooms, and the surface of the dome may be covered in windows, limiting privacy
- Numerous seams across the surface of the dome present the problem of water and wind leakage; dampness within the dome cannot be removed without some difficulty
- Acoustic properties of the dome reflect and amplify sound inside, further undermining privacy
- Zoning laws may prevent construction in certain areas, limiting geodesic domes to site specific functions, instead of being multifunctional

5 Conclusion

- The need for domes grew out of postwar population pressures, and access to a variety of new materials and construction techniques
- Traditional structures remained ubiquitous due to political, construction, and privacy concerns
- Exploding populations and new technologies may improve the viability of geodesic domes in residential and institutional settings in the future

6 Works Cited

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