

Gridadapter i kolfiber

samarbete mellan KTH och RUAG

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History

- Lattice structures have been frequently used through history
- Vladimir Shukhov
- Anisogrid lattice
- First hyperboloid structure, 1896
- The Shukhov tower in Moscow
 - 1920-1922
 - Projected to 350 m but built to 160 m
 - Uses three times less material than the Eifel tower

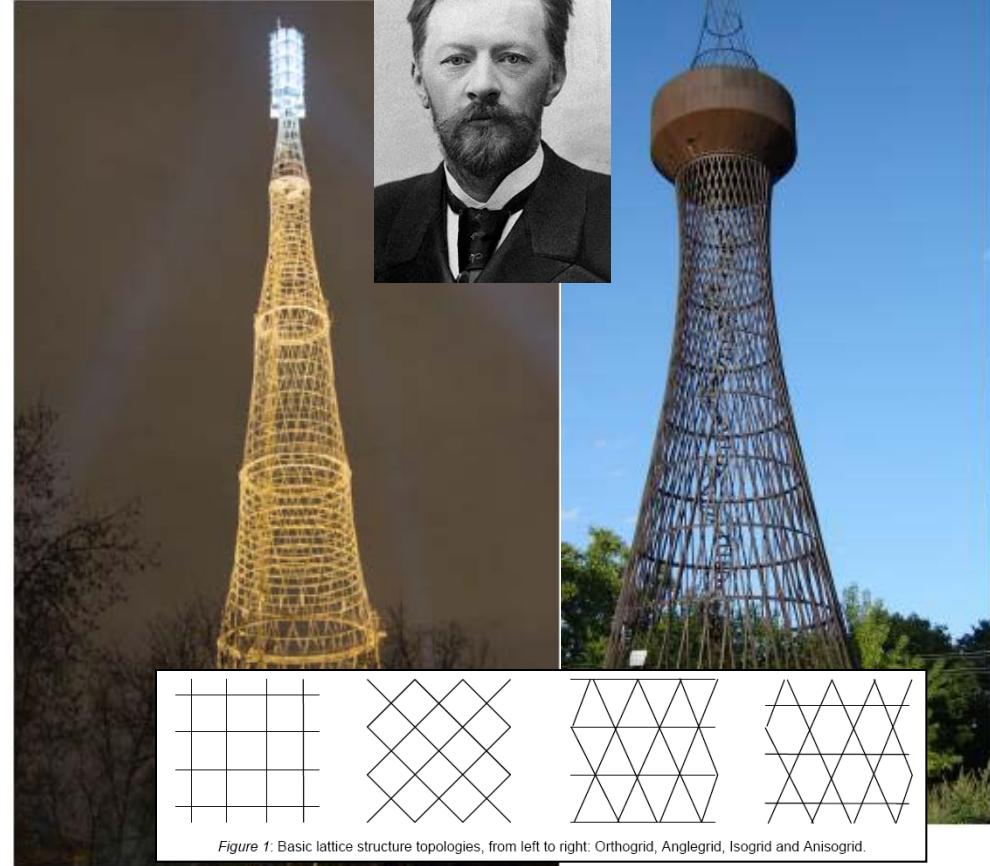


Figure 1: Basic lattice structure topologies, from left to right: Orthogrid, Anglegrid, Isogrid and Anisogrid.

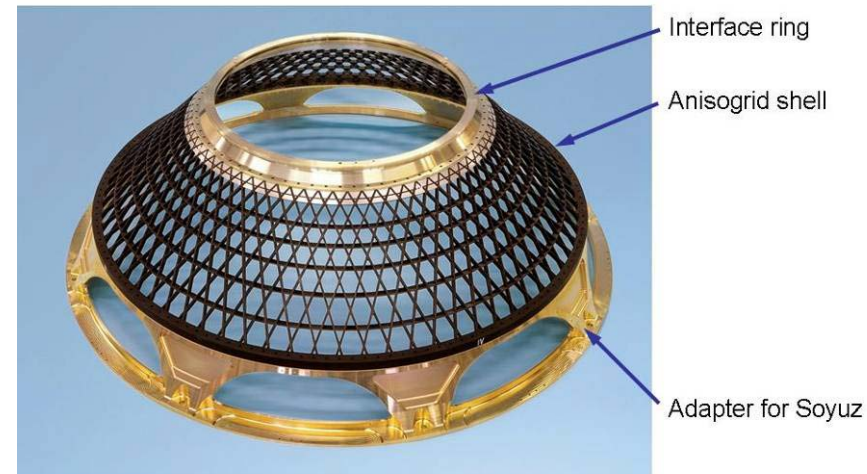
Modern Grid Adapter



- Central Research Institute of Special Machinery (CRISM)
- Filament winding process using a mandrel
- The hyperboloid geometry is adapted to fit the winding process (mathematically no longer a hyperboloid)

■ Benefits:

- **A robust structure**
self stabilizing in a way that reduces sensitivity to shape imperfections (under compression)
- **Low cost**
reduced number of man hours due to automatic process (tool cost for small number of units)
- **High specific strength and stiffness**



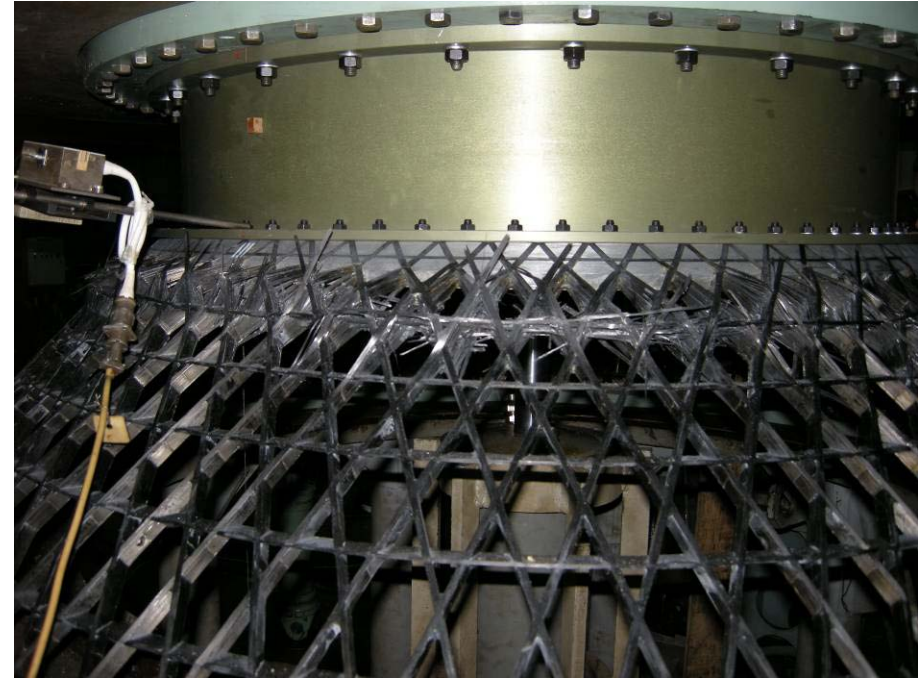
Russian vs. western design philosophy

- Western Philosophy
 - Source control
 - Mathematical model correlated with Qualification model
 - Large amount of documentation
 - NDT (Non-destructive testing)
- Russian Philosophy
 - Robust design
 - Testing ensures the correct quality
 - High finish only where needed
 - Limited documentation (faith in subcontractor)
- Philosophy for grid adapter
 - Rupture test on every 12th unit
 - Proof loading on every delivery unit



Development work

- Design and Manufacturing of Prototype (CRISM)
 - One unit for Rupture Test (2008)
 - One Unit for Proof Loading (2009)



- Analytical understanding of the Anisogrid Adapter
 - **Funded by NRFP**
 - Cooperation with KTH (Royal Institute of Technology)
 - Generic modelling and optimization (Master Thesis, 2008)
 - Structural Analysis (Master Thesis, 2008)
 - Post-test FE modelling (Report, 2009)
 - Design of dual launch adapter (Master Thesis, 2010)

LADEE – Lunar Atmosphere and Dust Environment Explorer

- First commercial application
- NASA mission: LADEE – Lunar Atmosphere and Dust Environment Explorer
- Launched in the beginning of 2013

- Weight and dimensions:
 - Upper diameter: 787 mm
 - Lower diameter: 1016 mm
 - Height: 457 mm
 - **Weight: 4.5 kg**
- Is able to sustain loads up to **32 metric tons!**

