Transformer Clepsydron: Deployable Support Framework with Varying Direction of Unfolding

Chichua, Temur

While creating models of objects with identical front and side views, I accidentally created an elementary cell, which is capable of transforming from a flat structure into a spatial object. Elementary cell of such a structure represents a four-link with fifth order kinematic pairs. The axes of kinematic pairs are focused such that they are crossed at the geometrical center of the cell. Thus it creates a spherical mechanism. The four axis of rotation form two imaginary pyramids; the upper pyramid is turned upside down and touches the top of the lower one. This creates a structure similar to an ancient Greeks water clock design known as "Clepsydra". Therefore I named a host of such structures presented in this competition "Clepsydron". Those cells are distinguished by the absence of any obviously expressed center and they are characterized by the symmetry of a Hyperboloid of one sheet of revolution with four direct generatrices of the right or left family. Depending on the ratio of the sizes of the structural members, the cells connected to each other form an arch or a direct spatial structure, if the cells in a chain are connected directly. If the chain is formed by a transition from the opposite to adjoining sides, structures with varying directions of unfolding are synthesized. Clepsydron is a mechanism with one degree of freedom. With application of an additional bound the unfolded structure is fixed in a spatially rigid design, forming a support framework for various land or space based devices.

Awards Won:

Fourth Award of $500