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MODULAR CONSTRUCTION OF LUNAR BASES USING TOPOLOGICAL INTERLOCKING

Abstract

Establishing lunar bases is a logical step in space exploration. Building of Lunar bases poses several challenges for the use of the traditional construction methods. Firstly, one deals with the absence of the basic building materials (e.g., cement, bricks, concrete) on the Moon such that all structural elements have to be delivered from the Earth. Secondly, one needs to prepare the ground for construction, which necessitates the use of heavy earth moving equipment. Last but not least, the structure should provide radiation and meteorite protection and withstand and mitigate the severe day/night thermal cycling. These challenges can be met by involving modular construction based on the principle of topological interlocking.

Topological interlocking is a special method of assembling blocks of simple shapes – the Platonic solids (tetrahedra, cubes, octahedra, etc.) – such that the blocks are kept in place by the virtue of their shape rather than a binder or connectors. The overall structural integrity is maintained by peripheral constraint effected by encompassing belts or cables. This presentation considers a structure where each block is a module (e.g. a living quarter). As the topological interlocking blocks have no connectors and allow some relative displacements, such structures are forgiving to the quality of the ground they are built upon, insensitive to extension/contraction caused by thermal cycling, show good vibration damping and damage localisation (e.g. localisation of destruction caused by a meteoritic impact). Finally, these structures are demountable permitting easy relocation when necessary. The modules of the shape of a Platonic solid can be delivered as nets with subsequent assembly in situ.

This presentation shows typical designs and properties of topological interlocking structures pertinent to extraterrestrial construction.