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TRITRUSS: A NEW AND NOVEL STRUCTURAL CONCEPT ENABLING MODULAR SPACE TELESCOPES AND SPACE PLATFORMS

Abstract

Modular structures that can be assembled on orbit will be the backbone for all future persistent missions, including in-space assembled telescopes and platforms for science and communications. The TriTruss is a new and innovative structural module that has been conceived by the NASA Langley Research Center for platform and telescope applications. Some of the innovative features of the TriTruss include: very compact packaging for launch, possibility of staged packaging, simple robotic deployment, ease of embedding payload components, innovative structural connector that has linear structural performance, ease of module-to-module robotic assembly, design versatility, and ease of customizing its design for specific applications.

This paper will introduce the TriTruss concept and describe how it can serve as the foundation for many different mission applications, in particular, a 20-meter diameter large space telescope and a beam-type platform that can host a variety of payloads and instruments. The geometry of the TriTruss will be described and the various truss design variables (such as truss depth, member diameter, material modulus, etc.) and each of their impacts on the truss performance will be illustrated. The TriTruss can be mapped to a variety of structural forms, such as beams, two-dimensional platforms and filled curved apertures (for antennas and telescopes) and examples will be illustrated. The TriTruss lends itself to a large variety of packaging schemes and the structural concepts associated with packaging and deployment will be described, as well as the means for robotically deploying TriTruss modules and locking them into their final configuration. TriTruss module-toTriTruss module robotic assembly operations will also be described. Equations and models have been developed to structurally size TriTruss modules, such that when assembled into the final persistent platform, achieve a desired level of global structural performance, and will be presented. A status of the TriTruss development will also be presented. This material will cover design and fabrication of TriTruss hardware for platform and telescope applications as well as structural testing of that hardware (the struts, connectors and platforms). Robotic assembly of TriTruss modules is also being performed and the results of those tests will be summarized.