Simulation and Experimental Predictions for the Structural Response of a Satellite
Master of Science Thesis Defense

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Chair of Advisory Committee: Dr. Helen Reed
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Abstract

This research investigated the structural response of satellites and space rated payloads. Throughout the work, SolidWorks Simulation was utilized to subject the aforementioned systems to both experimental test loads as well as program specific flight environments. While the methods presented within this document were exclusively employed with the SolidWorks Simulation software, all finite element analysis (FEA) techniques and computer aided design (CAD) best practices discussed are valid for a variety of commercially available CAD packages. Primarily, the programs under investigation were the Low earth Orbiting Navigation Experiment for Spacecraft Testing Autonomous Rendezvous and docking (LONESTAR) and Space-based Telescopes for Actionable Refinement of Ephemeris (STARE) programs. Both investigations studied satellite responses due to free and forced vibrations as well as various thermal environments and loading. Additionally, where experimental data was available, simulation solutions were validated against CAD generated values and evaluated for accuracy.

Ultimately, the natural frequency and random vibration responses of four systems are presented as part of this research and the sensitivity of these results, due to various modeling variables, is discussed. The transient and steady state thermal profiles of two satellite flight configurations are also presented in an effort to predict on orbit thermal conditions. The CAD tool was evaluated and deemed appropriate for investigative studies within the laboratory.

Angela McLelland is an MS candidate in the Aerospace Engineering Department working under the supervision of Professor Helen Reed. During her time as a research assistant at AggieSat Laboratory, Angela’s research interests included satellite design and structural analyses. Upon graduating Angela will be employed as a Structural Engineer at Piper Aircraft.