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Manufacturing and industrialization for Launch Vehicle and Space Vehicle Structures and components (High volume production, industrialization, automatization and digitalization) (7)

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LOW-COST STRUCTURAL SCALE MODELLING FOR SPACE SYSTEMS

Abstract

The dramatic increase in launch cadence in recent years provides ample orbit opportunities for small spacecraft as ride-shares. Increasing access to space technologies that can leverage this plethora of launches has the potential to provide targeted data for small communities and research groups, as well as service the needs of governments and telecommunications providers. Key barriers to space technology accessibility are the costly testing and analysis techniques traditionally used when developing space systems. Specifically, structural analyses and tests are often time consuming and expensive. Adopting alternative test methodologies for risk-tolerant spacecraft presents an opportunity to reduce costs and schedule times, thereby increasing accessibility. This paper investigates the feasibility of replacing full-scale structural testing to verify space system vibration requirements with simplified analyses and low-cost scale modelling. Fundamental components of a space structure are scaled using quasi-transfer functions. Simulation data from aluminum prototypes and plastic models using this approach show close agreement between primary vibration modes, with the accuracy of the scaling predictions decreasing into higher modes. Proposed methods to apply this component level scaling to full space systems are included. These scale modelling techniques enable faster, simpler, and less expensive testing for verification activities at various stages in space structure development.