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NANOSMAD - A SATELLITE MISSION ANALYSIS AND DESIGN TOOL FOR LEO NANO SATELLITES

Abstract

Most of the Space Mission Analysis and Design (SMAD) tools available in the industry are geared towards small and large satellites. Nanosatellites and micro satellites below 50 kg use a very different design philosophy leveraging Commercial-Off-The-Shelf (COTS) components, minimal redundancy, higher risk, rapid development times and shorter mission durations. Consequently, the relationships for satellite mass, power, pointing accuracy, design life, redundancy versus cost available in literature from general SMAD tools are mostly valid only for satellite platforms 100 kg and higher, built for 3+ mission design life. Here we would like to present NanoSMAD, a SMAD tool for Low Earth Orbiting (LEO) nano and micro satellite mission design, that is built on a database containing about 150 earth orbiting satellites and subsystem components. The database was constructed based on a survey of commercially available LEO nano and micro satellite products. We mainly include component level items with space heritage in our database. The analysis estimates relationships, between parameters such as satellite mass, volume, power, sensor and actuator type, pointing accuracy, transmit power, data rate and cost. These parameters can all be plotted against a choice variable such as cost or satellite mass, power etc. The tool enables a user to provide specifications for mass, volume, power, communication, pointing requirements to arrive at a preliminary satellite design and generate a Master Equipment List (MEL) for nano and micro satellite missions. The initial design and MEL can be customized further with more specific inputs or user choice of components from a drop-down menu. The model will then check for compatibility and provide feedback on validity of customized designs or where inconsistencies occur. Through this design process, users can arrive at a preliminary design and iterate to arrive at a customized design very quickly. The model is accessed using a web-based GUI which is built on Python. We are currently working on providing an accompanying costing estimate for the hardware as well.