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STEA: A NOVEL TOOL FOR SPACE THERMAL ENVIRONMENT ASSESSMENT

Abstract

The assessment of the space thermal environment is crucial for the success of space missions. The computational tool STEA "Space Thermal Environment Assessment" developed by OBO Space addresses this need by providing rapid and precise estimations of thermal loads, identifying critical orbital scenarios for mission planning. Conceived for early design phases, this Python-based tool evaluates incident fluxes—direct solar, albedo, and planetary infrared—and key thermal design parameters like beta angle, eclipse duration, sun aspect angle, and equilibrium temperature. These features are essential in guiding the design process, from material selection to structural optimization. The main advantage of STEA tool is the capability of quickly compute the incoming environmental fluxes for several subsequent orbits providing an overview of a mission thermal environment and identify critical cases that shall be used as sizing cases in the thermal control system design process. In addition, other useful parameters such as the Sun aspect angle, can be computed over the mission to provide useful input and requirement definition for the design of mission critical subsystems such as optical payloads and spacecraft power system. The paper presents STEA's architecture and its core functionalities, showcasing its applications through three distinct preliminary design case studies. These include the sizing of an optical telescope baffle, the design of a spacecraft radiator, and the estimation of solar array electrical power generation. Each case study underscores STEA's benefits in definition of sizing cases and requirements, enhancement in design accuracy and efficiency in the design process. The paper concludes with a discussion on the tool's ongoing enhancements, underscoring its evolving role in advancing space mission designs.