Occultation Modeling for Radiation Obstruction Effects on Spacecraft Systems

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A geometric occultation model has been developed to determine line-of-sight obstruction of radiation sources expected for different NASA space exploration mission designs. Example applications includes fidelity improvements for surface lighting conditions, radiation pressure, thermal and power subsystem modeling. The model makes use of geometric two dimensional shape primitives to most effectively model space vehicles. A set of these primitives is used to represent three dimensional obstructing objects as a two dimensional outline from the perspective of an observing point of interest. Radiation sources, such as the Sun or a Moon's albedo is represented as a collection of points, each of which is assigned a flux value to represent a section of the radiation source. Planetary bodies, such as a Martian moon, is represented as a collection of triangular facets which are distributed in spherical height fields for optimization. These design aspects and the overall model architecture will be presented. Specific uses to be presented includes a study of the lighting condition on Phobos for a possible future surface mission, and computing the incident flux on a spacecraft's solar panels and radiators from direct and reflected solar radiation subject to self-shadowing or shadowing by third bodies.

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