Using MathCad to Evaluate Exact Integral Formulations of Spacecraft Orbital Heats for Primitive Surfaces at Any Orientation

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Abstract

With the advent of high speed computing Monte Carlo ray tracing techniques has become the preferred method for evaluating spacecraft orbital heats. Monte Carlo has its greatest advantage where there are many interacting surfaces. However Monte Carlo programs are specialized programs that suffer from some inaccuracy, long calculation times and high purchase cost. A general orbital heating integral is presented here that is accurate, fast and runs on MathCad, a generally available engineering mathematics program. The integral is easy to read, understand and alter. The integral can be applied to unshaded primitive surfaces at any orientation. The method is limited to direct heating calculations. This integral formulation can be used for quick orbit evaluations and spot checking Monte Carlo results.

Outline

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2. Monte Carlo Inaccuracies
    a. Ray count and runtimes
    b. Spacial variations in radiosity field
3. Statement and Explanation of Integral
4. Calculating Orbital Heats on Flat Surfaces with Nadir Oriented Normal
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6. Calculating Orbital Heats on Curved Surfaces with Arbitrarily Orientation
    a. Hemisphere
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    d. Paraboloids
7. Calculating Heats in the Case that the Terminator Intersects the View Cone
8. Average Orbital Heat Example
9. Conclusions