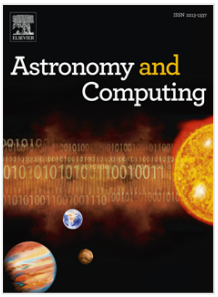
Accepted Manuscript



Eclipse prediction methods for LEO satellites with cylindrical and cone geometries: A comparative study of ECSM and ESCM to IRS satellites

Vineet K. Srivastava, Ashutosh, M. Pitchaimani, B.S. Chandrasekhar

PII: S2213-1337(13)00020-6
DOI: http://dx.doi.org/10.1016/j.ascom.2013.06.001
Reference: ASCOM 11

To appear in: *Astronomy and Computing*

Received date: 27 April 2013
Accepted date: 26 June 2013

Please cite this article as: Srivastava, V.K., M. Ashutosh,, B.S. Pitchaimani,, Eclipse prediction methods for LEO satellites with cylindrical and cone geometries: A comparative study of ECSM and ESCM to IRS satellites. *Astronomy and Computing* (2013), http://dx.doi.org/10.1016/j.ascom.2013.06.001

Eclipse Prediction methods for LEO Satellites with Cylindrical and Cone geometries: A Comparative study of ECSM and ESCM to IRS satellites

Vineet K. Srivastava, Ashutosh, M. Pitchaimani, B.S. Chandrasekhar

ISRO Telemetry, Tracking and Command Network (ISTRAC), Bangalore-560058, India
Email: vineetsriiitm@gmail.com

Abstract

In the present work, we discuss and assess the performances of Earth cylindrical shadow model (ECSM) and Earth shadow conical model (ESCM), with application to the Indian Remote Sensing (IRS), Low Earth orbiting (LEO) satellites; Cartosat-2A, Meghatropics-1, Resourcesat-2 and Oceansat-2. Both models are very simple and efficient for the prediction of eclipse states of any Earth orbiting eclipsing satellite at a given epoch. The advantage of using ESCM over ECSM is that first one predicts both states of eclipse; penumbra and umbra while the later one predicts only one which, in reality, is not true. The ESCM model can be effectively useful for the precise orbit prediction and satellite operation to utilize the power properly.

Keywords: ECSM; ESCM; Spacecraft position vector; Sun vector; Umbra; Penumbra.

1. Introduction

Most of the Earth-orbiting spacecrafts experience partial or full eclipse when the spacecraft passes through the dark side of the Earth. Apart from the occultation of the Sun by the Earth, the Moon may also cast shadow on the satellite; however these events occur less frequently and in a random fashion. Computation of eclipse conditions is generally applied for the Earth as the occulting body. These partial or total eclipse conditions correspond to the regions known as penumbra and umbra as shown in Fig. 1. The umbra region receives no direct light from the Sun and is in total darkness, and so there is no solar radiation pressure (SRP) while the penumbra region receives