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FAST COMPUTATION OF AREA TARGET VISIBILITY TO REMOTE SENSING SATELLITES

Abstract

The space-based image collection applications many times involve covering a large area of interest (AOI) by Remote Sensing Earth Observation Satellite Constellations. These satellites have pointable sensors with limited swaths. Due to the pointable nature of the sensors, they provide near-infinite ways of opportunities to cover portions of AOI. The first step in image collection planning and scheduling for an AOI is the computation of visible time periods of AOI using imaging satellites. Mainly there are two approaches for finding these visibility periods. In the first approach, the AOI is discretized into several point targets and the visibility to each point is computed. Discretization to finer resolutions is required for improving accuracies which in turn leads to an increase in computational effort, as many of the applications involve imaging of large areas of interest. The second approach considers the AOI as a whole and uses polygonal intersections to find the visibilities for possible imaging opportunities under the imaging sensor constraints. As the current generation agile satellites are capable to view in certain off-nadir distances, even this approach is computationally expensive as it requires to model for many off-nadir pointing options.

This paper presents an approach involving spherical trigonometry which is arrived at by combining insights from various existing methods, for improving the computational speed. This method is applicable for all area targets irrespective of their sizes and location on the Earth. The simulation results show around 95% decrease in computation time. We demonstrate how the area target visible time windows computation can be accelerated using simple spherical trigonometry.