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ATTITUDE STEERING TO ACHIEVE NEAR ZERO DOPPLER RESIDUAL FOR SAR BASED
IMAGING - A NOVEL APPROACH

Abstract

This paper describes a novel method to derive the attitude steering profile which is required to achieve near zero Doppler Centroid variation for spaceborne Synthetic Aperture Radar Systems. RISAT-1 is India's first microwave satellite with imaging capabilities in high and medium resolution. For SAR systems, attitude steering is performed to reduce the Doppler centroid variation which aids in data processing . The key is to align the SAR antenna direction, i.e. the spacecraft roll axis , to the resultant ground track velocity vector of the spacecraft . Once the antenna is aligned about roll , any amount of roll bias can be applied on the spacecraft without changing the attitude steering profiles and hence same profile is applicable simultaneously for left and right looking geometry. A new method based on vector-projection technique is devised to determine the yaw and pitch steering values . Yaw steering is required to compensate for earth rotation effect taking into account the oblateness of the earth and pitch steering is required to account for the orbit-eccentricity. The analysis also computes the Doppler centroid frequency using the spacecraft attitude data and it is found that the observed centroid variation is within +/- 100 Hz after accounting the pointing uncertainties of the actual control system.