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SYNCHRONIZATION STRATEGY AND OVERLAP RATIO OF BEAM FOOTPRINT FOR FORMATION FLYING INSAR SATELLITE

Abstract

Space-based interferometer relying on formation flying satellite nowadays presents a very promising approach to achieve large observation baselines with lower cost and higher flexibility. The space-borne synthetic aperture radar (SAR) has evolved into a mature technology over the past two decades, there is a growing interest in the single pass InSAR, included fully active SAR constellation and semi-active satellite formation. Fully active SAR constellations use two or more conventional radar satellites flying in close formation to acquire interferometric data during a single pass, such as twins satellite formations like the Radarsat2/3 tandemor TanDEM-X and multi-satellite constellations like the Techsat-21. Semi-active satellite formations use multiple passive receivers in combination with one conventional radar satellite, including Interferometric Cartwheel and Interferometric Cartwheel Pendulum concepts. It is the key factor that synchronization of beam footprint to meet with the formation flying InSAR satellite mission target. Thus, it is important to settle the synchronization of beam footprint for coordinated operation satellites. During the working time-interval of the fully active SAR constellations, such as TanDEM-X, the the continuous variation of relative position will lead to the corresponding variation for beam pointing angle of only received signal satellite and overlap ratio of beam footprint. The different synchronization strategies of beam footprint are presented in this paper and the antenna two-dimensional scanning precision and relative yaw angle error effect on overlap ratio of beam footprint is also discussed. It is indicated that the synchronization strategy of beam footprint has two reasonable methods, the regulation of relative pitch and roll angle or the antenna scanning of range-azimuth direction. It is the main influencing factor for overlap ratio of beam footprint that antenna scanning error of azimuth direction. In order to realize to satisfied beam footprint overlap ratio, the weight coefficient for the antenna two-dimensional scanning precision and relative yaw angle error must be reasonable balanced. This paper is organized as follows. In section 2, the coordinate system and image geometrical relationship is described. Next, synchronization strategy of beam footprint is put forward and realized in section 3. And finally, the synchronization overlap error model of beam footprint is described in section 4.