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ECHO ANALYSIS AND CORRECTION PROCESSING FOR ULTRA-HIGH RESOLUTION SPACEBORNE SAR WITHOUT "STOP-AND-GO" ASSUMPTION

Abstract

In conventional spaceborne SAR, "stop-and-go" assumption is always imposed. Nevertheless, this assumption will become invalid for ultra-high resolution spaceborne SAR, since highly accurate phase information is required to guarantee the optimal two-dimensional compression result. Consequently, the separation between transmit and receive location of the satellite, as well as the movement during pulse transmission and echo receiving period, must be considered in modeling the echoes for ultra-high resolution spaceborne SAR.

The separation between transmit and receive location of the platform entails that the echo range is the sum of transmit and receive ranges rather than twice as much as either range, thus these two ranges should both be modeled. Moreover, the movement during transmit and receive period will induce an extra intrapulse Doppler frequency, causing the discrepancy between the chirp rate of the received echo and that of the transmit pulse, as well as the deviation of the target location after the range compression procedure. These effects must be taken into consideration in the SAR imaging processing procedure to ensure the final image quality.

In this paper, we first analyze the echo model under the real operational condition, and show the difference from that under the above "stop-and-go" assumption. Secondly, the precise chirp rate of the received echo is acquired and then the corresponding range compression filter function is built based on this. Last but not the least, the target location must be corrected by the specific function with linear phase term, therefore the range cell migration can then be implemented in large scale. Simulation results are provided to verify the correctness of echo modeling and the effectiveness of derived compensation functions for ultra-high spaceborne SAR imaging.