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Author: Dr. Jian Liang
Northwestern Polytechnical University, China, liangjiancast@163.com

AN INNOVATION IMAGE FORMATION ALGORITHM FOR SPACEBORNE VIDEO SAR

Abstract

Video SAR(synthetic aperture radar) is a new imaging mode which can provide a continuous surveillance over a region of interest. In the spaceborne video SAR mode, the aperture time of each frame decided by the azimuth resolution typically exceeds the frame rate period. Therefore, an overlap in the collected raw data used to form consecutive frames is ineluctable. Normally, the frames are processed using the backprojection algorithm to avoid unnecessary duplication of processing, the algorithm is an $O(n^3)$ approach, it is restricted due to its great computation load even a variety of $O(n^2 log(n))$ approach have been developed. The paper details an innovative image formation algorithm for space video SAR based on the sub-aperture synthesis in range-Doppler domain. The phase history of each frame is divided into several sub-apertures whose length is equal to the azimuth interval between two consecutive frames. In each sub-aperture, RCMC(range cell migration correction) and SRC(secondary range compression) are made in frequency domain, thus the computational speed is greatly improved compared with BP algorithm. After RCMC and SRC, the frequency sub-band of sub-aperture are combined to achieve the desired high azimuth resolution. This innovative image formation algorithm can avoid the duplication of processing, and moreover, each sub-aperture can be processed to achieve the real time SAR video. The algorithm can also satisfy the imaging quality of video SAR in high squint mode. Simulation results show that the computation efficiency of the algorithm is superior to that of the BP algorithm. Finally, experiments on simulated and real data validate the effectiveness and performance of the proposed algorithm for spaceborne video SAR system.