SAR Information Integrated Processing and its application method study

Huadong GUO[1], Jie CHEN[2], Xinwu LI[1], Chunming Han[1], Guang LIU[1], Lu ZHANG[1], Guozhuang Shen[1]

[1]Key Lab of Digital Earth Sciences,
Institute of Remote Sensing and Digital Earth, Chinese Academy of Sciences,
No.9, Dengzhuang South Road, Haidian District, Beijing China, 100094
Tel:82178000, e-mail:guohd@radi.ac.cn
[2]School of Electronics and Information Engineering, Beihang University, Beijing 100191,
e-mail: chenjie@buaa.edu.cn

Abstract: Although Synthetic Aperture Radar (SAR) can capture rich land cover information as a most important advanced technique in the field of international earth observation, the application effects still limited significantly. The reason is that the study of SAR imaging processing, SAR image processing and SAR applications are conducted respectively, the integrated study are lacked for parameter selection of SAR imaging processing and SAR image processing and targets identification of SAR application. Focusing on above science problems, the study for phase high fidelity model of high precision interferometric SAR, SAR non-stationary backscattering characteristics and cognition, SAR three-dimensional electromagnetic scattering modeling and its scattering mechanism and SAR multi-parameters optimization information extraction has been conducted. The typical natural distributed targets and man-made targets such as surface deformation, sea ice, building complex and collapsed building are selected, the method and application study oriented to SAR environmental parameters inversion are conduced, the main result and conclusion are as follows:

（1）The overall theoretical frames of SAR information integrated processing was proposed; The simulation and ground validation system used to assess the effects of SAR information integrated processing was created; furthermore, the spaceborne SAR imaging algorithm with three steps focusing processing was proposed and realized the multi-modal integrated imaging processing and improved the imaging processing precision.

（2）In terms of SAR information integrated processing of natural targets, focusing on phase high fidelity imaging processing of interferometric SAR surface deformation monitoring, an novel spaceborne SAR high fidelity simulation method based on stationary RCS and improved Goldstein SAR interferogram filter based on empirical mode decomposition were proposed. Focusing on multi-parameters optimization processing of sea ice types classification, the

multi-channel spaceborne SAR sparse imaging method based on compressive sensing, kalman filter for removal of scalloping and inter-scan banding in ScanSAR images and SVM sea ice classification method combined with sea ice concentration were proposed.

（3）In terms of SAR information integrated processing of man-made targets, focusing on non-stationary backscattering from building complex，mitigation of azimuth ambiguities in spaceborne stripmap SAR iamges using selective restoration, SAR image despeckling by selective 3D filtering of multiple compressive reconstructed images and man-made target detection in urban areas based on a new azimuth stationary extraction method were proposed. Focusing on three-dimensional modeling and fast extraction of collapsed building, H-α-ρ method used for collapsed building extraction was proposed.

Key words: SAR information integrated processing, theoretical frame and model, phase high fidelity model, non-stationary backscattering, three-dimensional model ing