EARTH OBSERVATION SYMPOSIUM (B1)
Future Earth Observation Systems (2)

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STUDY ON MIMO-SAR SYSTEM BASED ON SPACE TIME CODING AND ELEVATION DIGITAL BEAM-FORMING

Abstract

Multiple Input Multiple Output SAR (MIMO-SAR) system, which employs multiple antennas to transmit orthogonal waveforms and receive echoes, is used to achieve high resolution wide swath observation. However, the imaging quality is seriously impaired by range ambiguity due to the existing cross-correlation after range matched filtering. MIMO-SAR with Alamouti Space-time Coding (ASTC), called ASTC-MIMO-SAR system, can eliminate the cross-correlation, enhance signal-to-noise ratio (SNR) and extract spatial diversity, but with unwanted resultsa double pulse repetition frequency (PRF) and the time-variant channel effect. To circumvent those problems, a novel MIMO-SAR system combined with ASTC and digital beamforming (DBF) operation both in azimuth and elevation, named DBF-ASTC-MIMO-SAR, is proposed in this paper. Different from ASTC-MIMO-SAR, the ASTC waveforms are transmitted in one pulse repetition interval (PRI). Although echoes corresponding to different ASTC sub-pulses are received in the same receive window, they can be separated by DBF operation in elevation. Echoes are then decoded with the Alamouti decoder and imaged with traditional imaging algorithms, just similar to the ASTC-MIMO-SAR system. Moreover, the shorter delay between two different transmitted coded signals can reduce the effect of time-varying channel response; the SNR and the imaging quality are also improved. All of these advantages are conducive to the realization of high-resolution wide-swath, and other applications.