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# APPLICATION OF SPACE TIME CODING AND ELEVATION DIGITAL BEAM-FORMING IN MIMO-SAR

**Abstract**

Multiple Input Multiple Output SAR (MIMO-SAR) system, which employs multiple antennas to transmit or-thogonal waveforms and receive echoes, is used to achieve high resolution wide swath observation and is superior to the traditional SISO-SAR in many aspects. However, the imaging quality of MIMO-SAR is seriously impaired by range ambiguity due to the existing cross-correlation after range matched filtering. Afterward ASTC-MIMO-SAR system which uses Alamouti Space-time Coding (ASTC) as the transmitting signal is proposed. 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.