RFI rejection in wideband SAR signals using LMS adaptive filters

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Abstract: We present the approach of Least-Mean-Square (LMS) adaptive filter for the removal of narrow-band radio frequency interference (RFI) from wideband synthetic aperture radar (SAR) signals. Three variations of the LMS adaptive filter are considered: the Time-Domain (TDLMS), the Frequency-Domain (FDLMS), and the Filter-Bank (FBLMS) LMS adaptive filters. The filters are tested with simulation and real SAR data. The simulator produces the range-Doppler image of a point target. It consists of a radar signal generator, thermal random noise and RFI generator, and an 8-bit (or BFPQ) A/D converter. The radar signal is characterized by its bandwidth, chirp slope, pulse length, caltone frequency, notching parameters. RFI sources include tones and communication signals of different modulation schemes (AM, FM, QAM, PM, communication satellite modulations, ...). Real SAR data are taken from existing data collected by the JPL P-band TopSAR/AirSAR programs. The filter performance, with respect to the filter parameters and input signal characteristics, is analyzed in terms of the radar performance parameters, such as the ISLR, PRSL, phase history, resolution, ... Finally, we compare the performance and throughput requirements of the three proposed adaptive filters.