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Multiple-input Multiple-output Ground Moving Target Indicator Radar: Theory and Practice

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Multiple-input multiple-output (MIMO) extensions to radar systems enable a number of advantages compared to traditional approaches. These advantages include improved angle estimation and target detection. In this paper, an overview of MIMO radar is provided, and the concept of coherent MIMO radar is defined. The principle focus of the paper is the discussion of MIMO ground moving target indication (GMTI). For GMTI radar modes, the advantages of a coherent MIMO architecture include improved angle estimation and enhanced slow speed target detection. To illustrate this, the concept of coherent MIMO radar is introduced and performance comparisons made between MIMO GMTI and traditional radar GMTI. These comparisons are supported by theoretical bounds, simulations, and experimental results for GMTI angle estimation accuracy and minimum detectable target velocity. For some applications, these results indicate significant potential improvements in clutter-mitigation, signal-to-noise ratio (SNR) loss, and reduction in angle-estimation error for slow-moving targets. The important effects of waveform characteristics is addressed.