Design of Transmit Beamspace and DOA Estimation in MIMO Radar

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Abstract : A multiple-input multiple-output (MIMO) radar systems use modulated waveforms and directive antennas to transmit electromagnetic energy into a specific volume in space to search for targets. This paper deals with the design of transmit beamspace matrix and DOA estimation for multiple-input multiple-output (MIMO) radar with collocated antennas.The design of transmit beamspace matrix is based on minimizing the difference between a desired transmit beampattern and the actual one while enforcing the constraint of uniform power distribution across the transmit array elements. Rotational invariance property is established at the transmit array by imposing a specific structure on the beamspace matrix. Semidefinite programming and spatial-division based design (SDD) are also designed separately. In MIMO radar systems, DOA estimation is an essential process to determine the direction of incoming signals and thus to direct the beam of the antenna array towards the estimated direction. This estimation deals with non-adaptive spectral estimation and adaptive spectral estimation techniques. The design of the transmit beamspace matrix and spectral estimation techniques are studied through simulation.

Keywords : adaptive and non-adaptive spectral estimation, direction of arrival estimation, MIMO radar, rotational invariance property, transmit, receive beamforming

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