Abstracts

Detection of Target Distance in the Presence of an Interfering Reflection Using a Frequency-Stepped Double Side-Band Suppressed Carrier Microwave Radar System

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A technique for detecting the distance to a highly reflective target in the presence of an interfering reflection using a frequency-stepped double side-band suppressed carrier (DSBSC) microwave-millimeter-wave radar system is analytically derived. Although this system is being developed for measuring nonuniform electron plasma densities as a function of distance from a heat tile on a space reentry vehicle, the technique is quite general and could be applied to other short-range radar problems. The main result of the analysis shows that the measured group delays produced by the DSBSC system possess a periodicity inversely proportional to the difference between the time delays to the target and interferer, independent of the signal-to-interference ratio (SIR), Thus, if the distance to the interferer is known, then the periodicity of the measured group delays may be used to extract the target distance, independent of SIR. Simulation results are presented in the context of electron plasma density range estimation using a block diagram communications CAD tool. A unique and accurate plasma model is introduced. A high-resolution spectral estimation technique based on an autoregressive time series analysis is applied to the measured group delays, and it is shown that accurate target distance estimates may be obtained, independent of SIR.

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