Abstract

The likelihood ratio test (LRT) based detection in the presence of a correlated non-Gaussian clutter encountered in high range resolution and/or low-grazing angle land and sea environments, has gained a special interest in recent years. The generalized likelihood ratio test (GLRT) detectors which are popularly used for optimum detection in Gaussian clutter environments are also promising to perform effectively in non-Gaussian clutter scenarios. For arriving at an accurate detection method, it is to be used a clutter model which is very accurately applicable to the actual non-Gaussian clutter encountered in practice. In this thesis, we formulate a GLRT detector using an accurate model of K-distributed clutter encountered in scanning radar application.

The work begins with an investigation on suitability and effectiveness of the LRT detection schemes available in the literature applied to such non-Gaussian clutter environments. The critical analysis on the detection performance of those detection schemes show that a more accurate model of scanning radar clutter is to be used while formulating an effective GLRT detection scheme which may need to use an accurate estimator for clutter mean power estimation.

Here, we propose a model for K-distributed clutter encountered in scanning radar applications taking the effect of scanning on the clutter correlation into consideration. The demonstrated experimental results show that the proposed model is consistent with the statistical characteristics of the measured practical data of both land and sea clutter. The model is found to be useful for estimating the mean power of clutter and attractive for use in LRT detection. Hence, the clutter model is suitably used for proposing a GLRT detector which yields an effective detection performance and promises to retain the desired constant false alarm rate (CFAR) while detecting fluctuating targets.

Keywords: LRT, GLRT detector formulation, K-distributed clutter modelling, Clutter mean power estimation, Antenna scanning, CFAR detection.