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Efficiency Estimation of Discrete Algorithms for Adaptation of Weight Coefficients in Space-Time Processing of Radar Signals

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Abstract—A comparative analysis of the efficiency of adaptive spatial filters with different methods of classified training sample formation under conditions of simultaneous exposure to active noise and passive interference is carried out. Based on the proposed methodology, analytical calculations of the changes in interchannel phase shifts for discrete algorithms for the adaptation of the weight coefficients of the spatial filter in various modes of operation of the 36D6 radar are carried out. It is shown that interchannel phase desynchronization/error arise at pause intervals in the adaptation of weight coefficients during antenna system scanning. The magnitude of these desynchronizations depends on the angular velocity of the antenna system rotation and on the repetition period of the radar pulses. An estimation of the suppression coefficient realized at the end of the pause in the adaptation of the weight coefficients taking into account the interchannel phase desynchronization is carried out. The recommendations on the choice of the formation method of the classified training sample under the conditions of the combined interferences are considered taking into account the losses that arise in case of discrete adaptation of the weight coefficients of the spatial filter.

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INTRODUCTION

In realistic conditions, both active noise and passive interference can affect the radar operation [1–3]. An active interference originates from the point sources of noise emissions located in the antenna farfield. Passive interference is generated by reflections of the radar own probing signal from local objects, hydrometeors, dipole interferences.

With the combined action of active noise interference (ANI) and re-reflections from passive reflectors, the spatially-distributed nature of passive interference destroys the spatial correlation of the active component of the combined interference. At distances in the angular directions, where the passive component of the combined interference is dominant, compensation of the active interference can be problematic. In addition, the presence of passive interference leads to a significant delay in transient processes in the adaptation of spatial or polarization filters [4].

Thus, to effectively compensate for active interference, it is necessary to generate a classified training sample (CTS) generated solely by the active component of the combined interference. However, the formation of the CTS by choosing a range interval with no passive interference, followed by its storage and use at other intervals, leads to pauses in the adaptive tuning of the compensation system against active interference, which limits the effectiveness of the interference compensation system. Therefore, the estimation of losses arising during the discrete adaptation of noise compensation systems is quite relevant.

The aim of the work is to analyze the effectiveness of systems of space-time signal processing for discrete adaptation of weight coefficients.

PROBLEM DESCRIPTION

Optimal filtering of useful signals under conditions of combined interference using adaptive antenna arrays can be provided by combined parallel (not separated) space-time processing with simultaneous

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