

# Enhancing Efficiency of Space-Time Processing of Radar Signals under Exposure of Combined Interferences<sup>1</sup>

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**Abstract**—The noise immunity of radars is essentially reduced under the simultaneous exposure to active noise and passive interferences. This is stipulated by the passive interference decorrelating the active noise and also by the disruption of interperiod correlation of passive interference during the adaptation of weight coefficients of spatial filter. This paper proposes and investigates a new method of forming the classified training sample (CTS) based on the interchannel correlation analysis of range signal. This method makes it possible (in the current sounding period in terms of the maximum magnitude of interchannel correlation coefficient) to determine the range interval, within which the passive interference has the minimum level, and to form the optimal value of weight coefficient of spatial filter for its use in the next sounding period. In addition, the method allows us to form an optimal weight coefficient for compensation of active noise interference in all sounding periods of the next frequency burst during the burst-mode signal processing in the last sounding period of the current burst. The simulation process has revealed that in this case the modulation of passive interference present in compensation channel is also eliminated. It can essentially enhance the efficiency of extraction of useful signals against the background of passive interferences during the time (frequency) processing at the second stage of space-time signal filtering in radars. It has been established that the use of CTS makes it possible to significantly reduce the duration of transient during the adaptation of weight coefficients of spatial filter that enables us to enhance the efficiency of active noise suppression under the simultaneous exposure to nonstationary passive interferences.

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## 1. INTRODUCTION

Noise immunity is one of the basic requirements placed on radars. This is typical for a wide range of radar equipment of both the military and civic assignments. The adaptive analogues capable of extracting the lacking information about the jamming situations directly from the input actions are of practical interest [1]. However, the efficiency of applying the known adaptive devices in conditions of exposure to combined interferences is significantly reduced [2–4].

This can be explained by the fact that the presence of passive interference (PI) disrupts the spatial correlation of active component of combined interference. In this case, the modulation of passive interference acting in compensation channels during the adaptation of weight coefficients of spatial filter violates the interperiod correlation of passive interference [4].

The well-known optimal classical structure of space-time filter consists of the tapped delay lines in each partial channel of phased antenna array and weight adders that form the required space-frequency characteristic. However, such structure of noise protection system proves to be unacceptable in the presence

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## CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

## ADDITIONAL INFORMATION

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