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Method of Forming Classified Training Sample in Case of Spacial Signal Processing under Influence of Combined Interference

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Abstract—Under the conditions of the combined interference, the operation efficiency of the radar equipment is substantially deteriorated. This is due to the decorrelation of the signals of the point source of active interference acting on the radar by passive interference. In this article methods of formation of the classified training sample, generated only by active interference, are considered for adaptation of the weight coefficients of spatial filters under conditions of combined interference presence. An effective method of forming the classified training sample generated by active masking interference was developed for spatial processing of radar signals under conditions of simultaneous exposure to passive interference. The developed method of forming the training sample is based on estimating the width of the normalized autocorrelation function in each element of the distance resolution. The current analysis of the combined interference components in each resolution element improves the quality of the interference component classification and, as a result, minimizes the effect of passive interference on the adaptation process of the spatial filter. The theoretical and practical aspects of the formation of the classified training sample are considered. The functional scheme of the classifier for the combined interference components is developed. The efficiency of the proposed method is compared with known correlation methods. The current analysis of the combined interference components in each element of the range resolution improves the quality of interference classification, which is important in the context of complex hydrometeorological conditions.

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INTRODUCTION

The most difficult operating conditions of the radar system is the simultaneous presence of active and passive (combined) interference [1, 2]. It is known that the sources of active masking interference can have both natural and artificial origin. However, regardless of their origin, they are point sources. Passive interference is caused by a reflection of the sounding signal from hydrometeors, clouds of dipoles, underlying surface. Passive interference destroys the spatial correlation of signals emitted by point sources of active masking interference. This leads to a significant deterioration in the quality of compensation for the latter.

Information on the spatial distribution of hydrometeors according to the range and altitude of their position suggests that the signals reflected from them are nonstationary in time domain. The signals reflected from the underlying surface and from the clouds of dipole reflectors are also nonstationary. Thus, the dimensions of a cloud of one batch of dipole reflectors in a vertical (horizontal) plane are 0.6–1 km in 5 min after discharge and 1.6–2 km in 10 min after their discharge [3]. Therefore, it can be assumed that, taking into account the real spatial distribution of passive interference on the range scan, it is possible to find time intervals for the formation of a classified training sample generated by active masking interference [4].

The use of the classified training sample in the spatial processing of signals ensures an increase in the efficiency of signal processing under conditions of combined interference, which determines the relevance of the proposed article.

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