Radioelectronics and Communications Systems
Vol. 48, No. 10, pp. 32–35, 2005

Izvestiya VUZ. Radioelektronika
Vol. 48, No. 10, pp. 45–50, 2005
UDC 621.396.96; 621.371.3

RECONSTRUCTION OF THE RANGE PROFILE OF PASSIVE INTERFERENCE IN THE PRESENCE OF A PROTRACTED RADAR TARGET

Ye. P. Mssalam

"KhAI" National Aerospace University, Kharkov, Ukraine

Based on the digital model of radar reflections from a protracted object moving along the sea surface, the problem of reconstruction of regular range profile of passive interference is resolved, when the interference arises from the rough sea surface. The results obtained can be used for improvement of accuracy characteristics of shipborne and coastal radar stations.

At the present-day stage of development of sea radar aids for detection and location of protracted objects, such as sea vessels (whose length may reach two hundred meters, while width and board height — several tens of meters) moving along the underlying sea surface, there arises a problem of suppression of interference-type reflections called passive interference. The difficulty of this problem is that, apart from reflection from the underlying sea surface, the spurious reflection of the "object-surface" type may occur. These interference reflections overestimate the true dimensions of radar image of the legitimate object under observation — both in azimuth and range. Also, we face strong amplitude fluctuations of the received signal in both coordinates. Moreover, the radar reflection from a protracted object shows large fluctuations in power (amplitude or intensity).

When dealing with the task of detection and location of sea vessels, the above mixed interference situation is most probable.

One of possible ways to substantial improvement of radar observability of legitimate sea objects in the above jamming situations is restoration of regular range profile of the interference from the results of analog-digital conversion of the full radar signal (the envelope at the output of radar video amplifier). In this case we have to suppress the legitimate signal which, if we desire to restore the regular range profile, represents in essence an anomalous outlier. First we must smooth it and restore it later by the method of subtraction of the range profile of the passive interference from the full radar signal.

The purpose of this work is to check the possibility of restoring the regular component of passive interference by known analytical methods and smoothing algorithms, with the use of computer-aided simulation.

The test signal model represents superposition of radar reflections, from a protracted target and the underlying sea surface, at the output of an analog-digital converter (ADC). Based on the results of heuristic synthesis of the digital single-dimensional model of radar reflections from the sea surface, let us present some basic analytical relations used subsequently for computer-aided simulation.

To facilitate the treatment of this problem, introduce several physically justified assumptions: the azimuthal direction is fixed ($\theta = \text{const}$); the longitudinal axis is parallel to the radar line of sight at $\theta = \text{const}$, and is aligned with it; the physical length L of the object is much larger than the geometric length $l_p = c\tau_p/2$ of the sounding signal (here c is the light speed, and τ_p is the sounding pulse duration); the maximal range of sounding $D >> L$; and the object is outside the dead zone R_1 of the radar system operation.

© 2006 by Allerton Press, Inc.

Authorization to photocopy individual items for internal or personal use, or the internal or personal use of specific clients, is granted by Allerton Press, Inc. for libraries and other users registered with the Copyright Clearance Center (CCC) Transactional Reporting Service, provided that the base fee of $50.00 per copy is paid directly to CCC, 222 Rosewood Drive, Danvers, MA 01923.

REFERENCES

1. Ye. A. Shtager, Scattering of Radio Waves on Bodies of Complex Shape [in Russian], Radio i Svyaz', Moscow, 1986.

2. G. P. Kulymin and V. B. Razskazovskii, Scattering of Millimeter Waves by the Earth's Surface at Small Angles [in Russian], Naukova Dumka, Kiev, 1987.

3. Ya. D. Shirman and V. N. Manzhos, Theory and Techniques of Processing of Radar Information against Interference Background [in Russian], Radio i Svyaz', Moscow, 1981.

27 May 2005