Essence of Radio Signals Processing in Close Range Reconnaissance

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Abstract - **In this paper the approach to make a high resolution in radar is given. The structure of radar system with projector matrix filters is depicted.**

Keywords - **signal processing, high resolution, projector matrix filter, close range reconnaissance (CRR).**

INTRODUCTION

The detection of objects of potential threat at on near distances (from hundreds meters to 4…6 km) is still an important task. The radars are used due to their all-the-time, and real-in-time service and exactness. This is the reason of intensive development of radar systems for near reconnaissance and nowadays the leading producers propose the wide row of radar equipment.

It is obviously that such radar will bring to work the principle of adaptive digital diagram forming. Calculable possibilities of modern signal processors allow to use the signal processing algorithms of some complication in radar systems with antenna arrays.

ESSENCE OF PROJECTOR SIGNAL PROCESSING ALGORITHM

The functions of CRR by means of radar are the following. There are simultaneous motion objects detection and tracking, when their effective scattering surfaces differ in times and orders, and when active and passive interferences influenced the radar. The possible effective signal processing algorithm in such conditions is the projector one with matrix filters [1].

The similar signal processing algorithms needs to determine the square form of the signal function taken on the elements of linear antenna array (AA). The proposed projector algorithm says the signal function must be multiplied with varied (tuning) multidimensional matrix filter, which (the filter) matches the directions on detected objects. So the number of objects in radar detection field determines the dimension of projector matrix filter.

Another principal difference of proposed projector algorithm is the following. It doesn't demand the determination of correlation matrix of signals and interferences. As we know this action is obligatory for well-known high resolution algorithms, including other projective ones.

However, it doesn't mean the proposed algorithm has no high resolution possibilities. It is known [2] these possibilities with resolution exceeding Raleigh boundary exceptionally depend on a SNR. Therefore to provide the radar with the necessary SNR, it is possible to have high resolution of projector algorithm due to the optimal tuning of projector matrix filter on directions of detected objects. It is mentioned that tuning takes place within the boundaries of antenna direction diagram. It is clear the optimal tuning maximizes the square form of signal function.

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The quantitative calculations of the possibilities of the detector based on projector algorithm and alternative algorithm are in [3] and [4].

The radar structure with projector matrix filter for detecting of compounded objects is shown below (look Fig. 1).

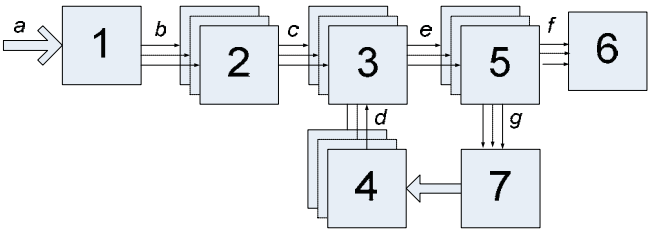

Fig. 1 The radar structure with projector matrix filters: 1 a digital AA; 2 radar (Doppler) receiving channels; 3 a set of projector matrix filters; 4 a projectors former and estimating vectors former; 5 a square form calculator; 6 a connector of channels with the threshold units and radio visualization; 7 a signal processor.

CONLUSION

There are some specific features in CRR with radar to take into account when producing and signal processing.

First of all there is a wide range of values of effective scattering surfaces of detected objects due to their different classes of the objects.

Secondly the detected objects are non-point, but distributed probably [5].

Above mentioned detects forming both signal function and estimating vectors which form the corresponding projector matrix filters.

These items are going to be researched.

REFERENCES

[1] B. F. Bondarenko, S. Yu. Platonov, and V. Yu. Tymchuk, "New processing algorithms improve resolution of coherent signals," *Radioelectronics and communications systems*, vol. 46, No. 4, pp. 46–50, 2003.

[2] Skolnik, M. "Handbook on Radiolocation," *NY*, 2008

[3] B.F.Bondarenko, I. M. Sashchuk, and V. Yu. Tymchuk, "Detection quality and maximum attainable resolution of correlated signals in detectors based on the Keypone algorithm," *Radioelectronics and communications systems*, vol. 47, No. 7, pp. 32–36, 2004.

[4] B.F. Bondarenko, G.M. Bondarchuk, and V.Yu. Tymchuk, "Predel'noye kachestvo obnarugheniya i razresheniya signalov v obnarughitele na osnove soglasovannoho proektora," *Izv. VUZ. Radioelectronika*, vol. 48, No. 3, pp. 24–33, 2005 [in Russian].

[5] Ostrovitianov R.V., Basalov F.A. "Statisticheskaya radiokokacija protiaghennyh celej," *Radio i sviaz'*, 232 pp., 1982 [in Russian].