TOMOGRAPHIC METHODS OF CONTROLLING REFLECTIONS FROM LOCAL OBJECTS

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The use of prior information about the shape of the radiation pattern (RP) makes it possible to determine the spatial distribution of the effective surfaces of repeated reflection of local objects invariant to a change in the parameters of the RP. The use of a novelty filter (instead of subtraction) for compensating reflections from local objects eliminates the effect of the radar receiving-amplifying channel on compensation of the parameters. The simplest method of compensating reflections from local objects is storing video signals for each orientation of the RP in a mapping mode and subtracting this signal in the on-line target detection and tracking mode. Such an approach would be sufficiently effective if the shape of the RP, parameters of the receiving and transmitting channels of the radar, and also the media of propagation in the mapping and on-line modes remained unchanged. Unfortunately, it is not possible to achieve this, and not only for technological reasons. Modern radars, e.g., the "Patriot," use a set of phased arrays for forming the RP, making it possible by adaptive methods to change the shape of the RP for controlling noise. This means that the shapes of the RP in the mapping and on-line modes as well as the video signals reflected from local objects will be different and their subtraction will not produce the expected compensation results.

For these reasons, during mapping it is necessary to estimate and record in the memory not the video signals of reflections from local objects but the spatial distribution of the effective scattering surfaces of local objects.

The RP is determined by the scalar product of two vector

$$F(r, w) = S^T(r)\, w, \tag{1}$$

where r is a unit vector of the direction of orientation of the RP; w is the pattern-forming vector; S(r) is the direction vector, determined by the spatial phase incursions for a given direction.

We will partition the zone of responsibility into direction resolution elements and determine the amplification of the RP (1) for each resolution element: $F(r_1, w)$, $F(r_2, w)$, ... The set of these gains comprise the vector $f(w)$ - a discretized RP $f(w) = S^T w$, where $S = [s(r_1) \vdots s(r_2) \vdots \ldots]$ is the matrix of direction vectors.

We will denote the density of repeated reflections of local objects in the investigated zone of space by $\rho(r, t)$, where t is calculated from the time of the radar probing pulse and therefore determines the distance to the object of repeated reflections. At time t_i, with consideration of the adopted discretization of the direction resolution elements, we obtain the vector

$$g(t_i) = [\rho(r_1, t_i), \rho(r_2, t_i) \ldots]^T. \tag{2}$$

At time t_i the signal at the output of the phased array $y(t_i, w)$ is formed by all reradiating resolution elements located at a distance corresponding to t_i with consideration of the gain in the given direction $y(t_i, w) = g^T(t_i) f(w) = g^T(t_i) S^T w$.

We introduce discretization of the zone of responsibility with respect to range in conformity with the resolving power of the radar. A time interval from the probing pulse to the reflected pulse t_i corresponds to each range resolution element. To the set of t_i corresponds the vector of the signals being received by the phased array - the vector of measurements