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Calculation Algorithm of Optimal Values of Weight Coefficients for Coherent Integration of Reflections

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Abstract—A formula for computing the optimal values of weight coefficients of coherent integration of reflections has been proposed for minimizing the sidelobe level of amplitude-phase characteristics (APC) of Doppler filters applicable at an arbitrary number of such filters. The AFC plots of Doppler filters were calculated and presented for the case of coherent integrator for 8, 12, 16, 24, 32 and 36 filters. The estimated average sidelobe level indicated the validity of specified proposals.

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1. INTRODUCTION

The complexity of implementing the monopulse methods of aircraft direction finding at the final phase of landing in conditions of poor visibility of runway involves a strong impact of reflections from the earth surface and meteo-clouds on the direction finding accuracy. The compensation of such phenomenon in monopulse radar for autotracking of aircraft landing is a problem-plagued task.

Paper [1] analyzes the possibility of implementing monopulse channels of aircraft direction finding in the course and elevation planes by two techniques was analyzed in paper [1] under an assumption that the problem of compensating the disturbing effect of passive jamming (PJ) was solved. Paper [2] proposes the values of the sidelobe smoothing coefficients of amplitude-phase characteristics of 16 Doppler filters.

The present paper proposes a calculation formula for optimal values of weight coefficients of accumulation of reflected pulses for minimizing the sidelobe levels of amplitude-phase characteristics of Doppler filters applicable at an arbitrary number of such filters.

2. MAIN BODY

Advantages of monopulse methods of determining the angular coordinates of target stipulate the expediency of their realization for ensuring the control of aircraft landing in conditions of poor visibility of the runway. In this case, the compensation of interfering impact of PJ can be achieved only by the Doppler filtering of reflections in monopulse radar station for autotracking of individual aircraft.

The efficiency of ordinary Doppler filtering of reflections in surveillance radars is limited by two factors:

– the number of implemented Doppler filters that is limited by the number of pulses in a packet;

– accumulation of target pulses moving with specific (“blind”) radial speed together with PJ in zero Doppler filter and the need for wobbling the probing period for the reduction of such accumulations.

The aircraft autotracking radar is free from the first limitation, and for the elimination of accumulations of target pulses in zero Doppler filter it is possible to optimally select the value of radar probing period on the basis of measuring the target radial speed [2].

That is why for an autotracking radar of aircraft landing it is possible to substantially increase the number of Doppler filters in coherent integrator (CI) and implement the optimal weight accumulation of reflected pulses.

Let us analyze the conditions and obtain a calculation formula of optimal values of weight coefficients for arbitrary number of filters and test the obtained formula for validity.

We shall assume that the obtained optimal values of weight coefficients for 8 Doppler filters are as follows: