Determination of parameters for digital meter of doppler radars systems for the artillery systems

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Annotation - **analytical choice of the digital meter parameters based on digital systems of phase synchronization (DSPS) is considered, also the simulation model design in order to perform the optimization of its parameters and to determine the temporary characteristics and the accuracy of the motion parameters of objects estimating, for the systems with autonomous navigation and ballistic training artillery systems.**

Keywords - **digital system of phase synchronization, analytical and simulation models**

I. INTRODUCTION

Under the conditions of modern warfare there is the urgency to complete each artillery system with the means which allow to determine automatically survey and ballistic information - Doppler radars with the permanent radiation of millimeter diapason [1].

The aim of the paper is is determination of main parameters of the digital Doppler radar's meter basing on analytical synthesis, and their adjustment with the simulation method.

II. MAIN PART

The analytical selection of the digital meter's on DSPS basis parameters is carried out using an analysis of their transfer functions. In spite with the analog implementation it requires ttransfer from differential equations to difference ones using z-transformation in their description and replacement of the Laplace transform by z-transform [2]. Then, for input action

$$\Omega_C(t) = \alpha t, \quad \varphi_C(t) = \alpha t^2/2,$$

dynamic error DPLL will be:

$$M\varphi = \alpha T_и^2 / K_{b2}, \qquad (1)$$

and fluctuation error is described by:

$$\sigma_\varphi^2 = N_д^*[K_{b1}^2(K_{b1}+2)+K_{b2}(K_{b1}^2+K_{b1}K_{b2}/4+ \\ +K_{b1}+K_{b2}/2+2)]/[2K_{b1}(2-K_{b1})-K_{b2}(2+K_{b1})]T_н, \qquad (2)$$

while conditions of stability are as follows:

$$\begin{cases} K_{b1} \rangle 0, \\ K_{b2} \rangle 0, \\ K_{b2} + 2K_{b1} - 4 \langle 0, \\ 2K_{b1}K_{b2} + 4K_{b2} - 8K_{b1} + 4K_{b1}^2 \langle 0, \end{cases} \qquad (3)$$

where the $K_{b1} = 2k_д K_1 \pi \Delta F T_н$, $K_{b2} = 2k_д K_2 \pi \Delta F T_н$ - dimensionless coefficients of the transmission loop filter, $\Omega_C(t), \varphi_C(t)$ - frequency and phase of input signal, $k_д$ - the transfer factor of the discriminator, K_1, K_2 - transfer the digital filter coefficients, respectively, on a proportional and integrating loops, ΔF - discrete adjustment digital frequency synthesizer, $T_н$ - averaging interval quadrature counts.

To optimize the measuring, algorithms and simulation programs are developed. They allows to analyze meter's work considering implementation errors, and to adjust choosen accordingly with expressions (1-3) values $T_н, K_{д1}, K_{д2}$.

III. CONCLUSIONS

Performed studies proved that analytical methods allows to determine only an approximate values of parametres for the digital meter on DSPS basis. At the same time, the methods of DPLL simulation allow to perform an analysis both an individual parts and whole DSPS generally, to define timing data of transition processes and an accuracy of estimation of the movement parametres.

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