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АНАЛИЗ ДИНАМИЧЕСКИХ ХАРАКТЕРИСТИК ГИРОСТАБИЛИЗИРОВАННОГО АНТЕННОГО УСТРОЙСТВА

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The topicality of theme is explained by necessary of providing precision characteristics of the gyrostabilized scanner, taking into account dynamic characteristics of system.

The Gyroscopic Systems (GS) are used for various mobile objects to the solution of problems of control, orientation and navigation. In particular, are widely used in navigation devices and control systems of the ships and aircraft, and also the orientation of the antenna systems, telescopes and other devices installed on moving objects.

The main element of any gyroscopic system it is gyroscope with two or three degrees of freedom, including freedom degree concerning its main axis.

According to the principle of the gyroscopic systems are divided into:

1) The direct – the devices that are used directly stabilizing properties of three-stage gyroscope.

2) The power — the electromechanical devices containing besides the gyroscopes, special engines for overcoming of impact on the stabilized object of the external revolting moments.

3) Indicator – the systems of automatic control in which the gyroscopic devices installed on stabilized object (for example, platform), are the sensitive or setting the elements that determine the object's position and control the watching systems. Stabilization of object (platform) is carried out by means of watching systems.

In this work the element of watching system, namely the navigation antenna (the antenna-feeder unit of the AK-20M device, ship-based) is considered, which uses a gyroscopic system indicator type.

The design of antenna-feeder unit of the device AK-20M, considered as a part of this dissertation is a double reflector antenna with a diameter of reflector of 1800 mm.

Precision characteristics of the GS – are the main factor is that determine the effectiveness of the task, set for orientation or navigation system. However, the basic property of the gyroscope is broken by the action of the harmful moments concerning axes of subweight and leads to a significant increase in the errors of the measurements.

To assess the accuracy of stabilization is the determining angle stabilization.

With the following discussion as a basis method of logarithmic amplitude characteristics (l.f.h.) is assumed, as one of the most advanced methods of engineering synthesis of automatic control systems.

The logarithmic amplitude characteristic, which should have a system that is desired, should be located in the low frequency region is not below a control point A_k (Figure 1).

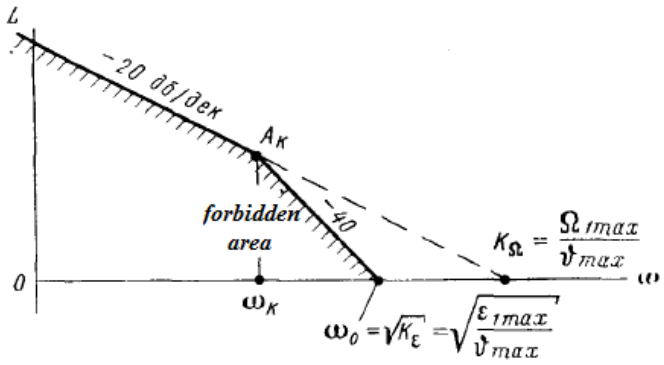

Figure 1 – Forbidden area

Where ω_0 – the minimum resonant frequencies, rad/s;

$\varepsilon_{1\max}$ – the maximum angular acceleration of operating influence;

$\Omega_{1\max}$ – the maximum speed;

K_Ω – goodness on the speed of system, s^{-1}.

In figure 1 it is shown that below a control point indicators of system worsen, and use of this area isn't relevant to high-quality work of system. If l.a.h. won't come into forbidden area, the error of reproduction of an angle in system does not exceed the specified amount of a dynamic mistake.

By the results of the calculations the basic frequency of system, is equal to:

$$f_0 = \frac{\omega_0}{2\pi} = 5.8\text{Hz}.$$

The resonant frequencies of own fluctuations on all axes of rotation of the antenna should be $\geq 3 \cdot f_0$, that is $\geq 17{,}3Hz$.

The platform considered above is an element of the first step of stabilization – a vertical axis of targeting. On it in separate cardano subweight the second platform which is stabilized in space with higher precision in addition is established, than the first, and goes further the third platform. Therefore, further calculations of speeds and angular accelerations, it is necessary to carry out taking into account transformation of coordinates.

To solve this problem it is proposed to use the finite - element method of simulation by means of the software product ANSYS Workbench.

In conclusion I'd like to say that the resulting finite - element model of the gyrostabilized antenna device has been analyzed and investigated on the resonance frequencies, for the purpose ofensure the required accuracy of the guidance system.