A. Zakharova, Master student,
D. Shostachuk, PhD, Ass. Prof., research advisor,
N. Krushynska, lecturer, language advisor,
Zhytomyr State Technological University

ORIENTATION METHOD OF SATELLITE WITH PREDICTIVE MODELS OF DISTURBANCES AND MAGNETIC MOMENT OF FORCE COILS

Despite the difficulties caused by the transition to a market society, Ukraine stays as the space state and the traditions that have been accumulated in the space tool and rocket building over the past decades must be developed. This is also applied to systems of managing trajectory of the satellites.

The trajectory of the satellite is different from the orbits of celestial bodies naturally occurring mainly by the presence of active sites, which included satellite movements from a jet engine or magnetic drive. The orbits of satellites continuously change under the influence of disturbing forces. Specified values are used to predict the orbits of satellites movement in these observations.

In the master project it was offered the changing motion of satellites using the Earth's magnetic field and the magnetic field of the force coils. The coils will be connected to a power source to the points where the amplitude of disturbances is maximal.

In the software environment Mat LAB (tools package Simulink) we simulated two systems: a system of continuous motion control of satellites and a system of motion control of satellite that is based on the method of using predictive points of disturbances. On the input of each system harmonic signal is supplied (Figure 1):

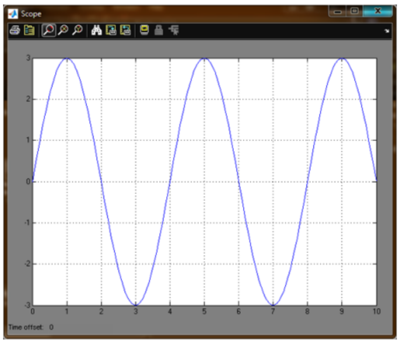

Fig.1. Image of input signal

Scheme of continuous control of satellite is shown in Fig. 2. In this system transfer function of the feedback is used as a controller. The system continuously controls the adjustable parameter and produces a control signal. Effect of continuous control of satellites is visible in Fig. 3, which shows the graph of the output signal of the system.

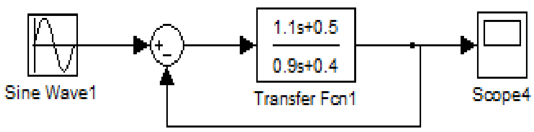

Fig.2. Scheme of continuous motion of controlling satellites

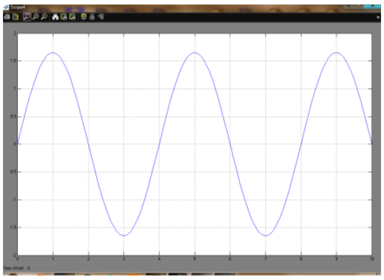

Fig.3. The output signal of continuous control system

Scheme of satellite motion control is based on the method of magnetic orientation shown in Fig. 4. In this system periodic signal generator Repeating Sequence Stair was used as a regulator which would react to disturbance at certain time. Object with the transfer function $W(s) = \frac{1.1s + 0.5}{0.9s + 0.4}$ was adopted as the model by the satellite.

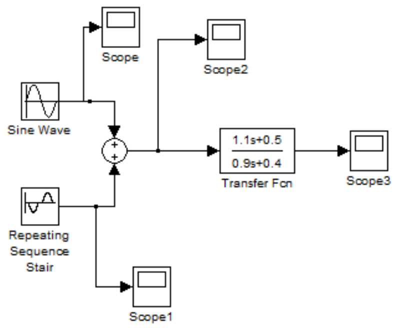

Fig.4. Scheme of satellite motion control system based on the method of magnetic orientation

As can be seen from the graph of output signal of object (Fig. 5), the system periodically generates the necessary step pulses what cut off effect of geomagnetic disturbances on the trajectory of the satellite in those moments when the disturbance reaches its maximum value and can significantly change the trajectory of the satellite. The result of the use of motion management system of satellites based on the method of magnetic orientation is clearly visible on the graph of the output signal (Fig. 6).

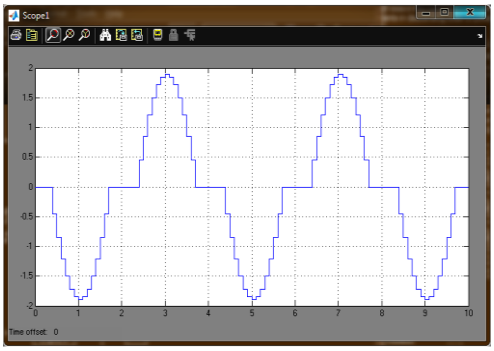

Fig.5. The image of output signal of generator Repeating Sequence Stair

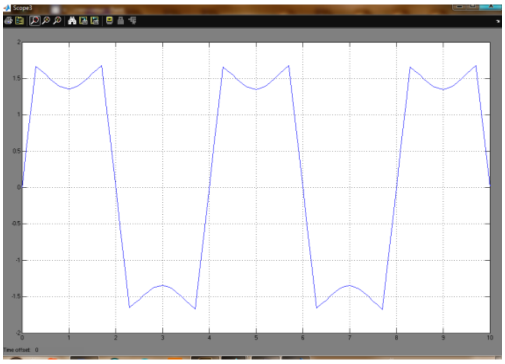

Fig.6. The output signal of management system that is based on the method of magnetic orientation of satellites

Analyzing graphics signals both systems were identified power consumed by the period: P1 = 6.8W (continuous control system satellites) and P2 = 3.412W (proposed system of a motion control of satellites). Thus we can conclude: the proposed control system is less energy-intensive, because it worked only in moments of maximum action disturbances, in contrast to the continuous system what always operate with the managed object. Reduced cost of control system minimizes energy consumption and hence to life extension of satellites.