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Y. Andreyeva, Master student
O. Andreyev, PhD in Engr., As. Prof., research advisor
L. Mohelnytska, PhD in Phil., As. Prof., language advisor
Zhytomyr State Technological University

DETERMINATION OF THE LOCATION OF RADIO EMISSION SOURCE FROM A SPACECRAFT

Nowadays our Motherland actually takes part in warfare in the east of Ukraine. That is why it is extremely important to provide Ukrainian Armed Forces with up to date operational intelligence information about the location of the enemy. An important part of carrying out the combat missions is the means of electronic security, such as radiocommunication, radiolocation, radionavigation etc. For instance, means for detecting the flight path of enemy missiles and mines are based on the use of radar systems (RS). To detect a target, the radar system emits a signal of a given frequency. It determines the direction and distance to the target relatively to the radar. In order to do that, RS analyzes the parameters of the reflected signals from the target. Means of radionavigation and radiocommunication also fulfill their tasks by using radio waves. If enemy's RS emits radio signal (i.e. radio waves), it is possible to determine its location and destroy this RS (especially if it is used to navigate missiles).

The Ukrainian government supports the development of aerospace industrial complex. That is why Ukraine has its own space program. This program provides increasing of the efficiency of space exploration facilities, which can perform monitoring tasks by examining the earth's surface from spacecraft in the radio range, despite the time of the day and meteorological conditions.

If an object located on the earth's surface emits a radio signal, spacecraft receiver's input will get another signal frequency. It will differ from the frequency of the object, by a value that depends on the movement of the spacecraft relatively to the radar system. This frequency increment is called the Doppler frequency. After measuring the frequency of the signal, it is possible to determine the law of changing the Doppler frequency on the interval of observation. This interval has to be divided into two parts. By integrating the Doppler frequency change equation, it is needed to determine the difference of the range from the source of the radioemission at the beginning and at the end of those two parts of the interval. Therefore, we have two differences in ranges and the law of the movement of spacecraft. With the help of it, it is possible to determine the coordinates of the position of the radar system on the earth's surface.

The results of the simulation showed that at a flight altitude of 650 km, the accuracy of the location of a radar station that emits a signal at a frequency of 3 GHz is no more than 3 km, with a distance between the radar and the spacecraft to 1000 km.

Thus, this method provides estimating the position of the source of radioemission from a spacecraft when the location of the radar station and its signal parameters are unknown. It should be noted that the accuracy of the location of the RS depends on the precision of the measurement of the Doppler frequency at the interval of observation. It is extremely complicated to proceed the perfect measurement. The difficulty is that there

may be occasional changes in the frequency of the device, distorting the result of the measurement of the Doppler frequency.

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