

LINEARIZATION OF ANGULAR CHARACTERISTICS OF THE SUN SENSOR FOR THE PolyITAN-3 SATELLITE

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The Sun Angular Coordinate Sensor (sun sensor) of the PolyITAN-2 satellite had a number of inaccuracies in determining the Sun's coordinates, so the sensor needed modernization, that is, improved measurement accuracy [1]. Errors in determining the position of the spacecraft of this sensor are: nonlinear signals (angular characteristics), which are explained by an uneven change in the pitch of the displacement of the sunspot. The sensor support elements respond to the illumination change in two coordinate axes, which further increases the measurement inaccuracy.

In order to optimize the operation of the sensor and to resolve these inaccuracies, it is necessary to change the geometric dimensions of photosensitive elements and to investigate the effect of geometric dimensions and shape of the photocells on improving the determination of the coordinates of the sun.

The modification of the shape of the photosensitive elements was that the change in the shape of the photosensitive elements of the support and the working channels compensated the loss of power. This means that one side of each element is described by a function inversely proportional to the power loss.

Fig 1 shows the dependence of the voltage on the change in the angle of incidence of sunlight at the vertical position of the sensor. The deviation of the real characteristics from the expected are from -0.03 to 0.04 V, but they almost coincide with the real in the whole range of measurements of the angular characteristics.

When comparing the angular characteristics of the prototype sensor with the sensor mounted on the PolyITAN-2 satellite, we can conclude that the obtained characteristics of the prototype are almost linear.

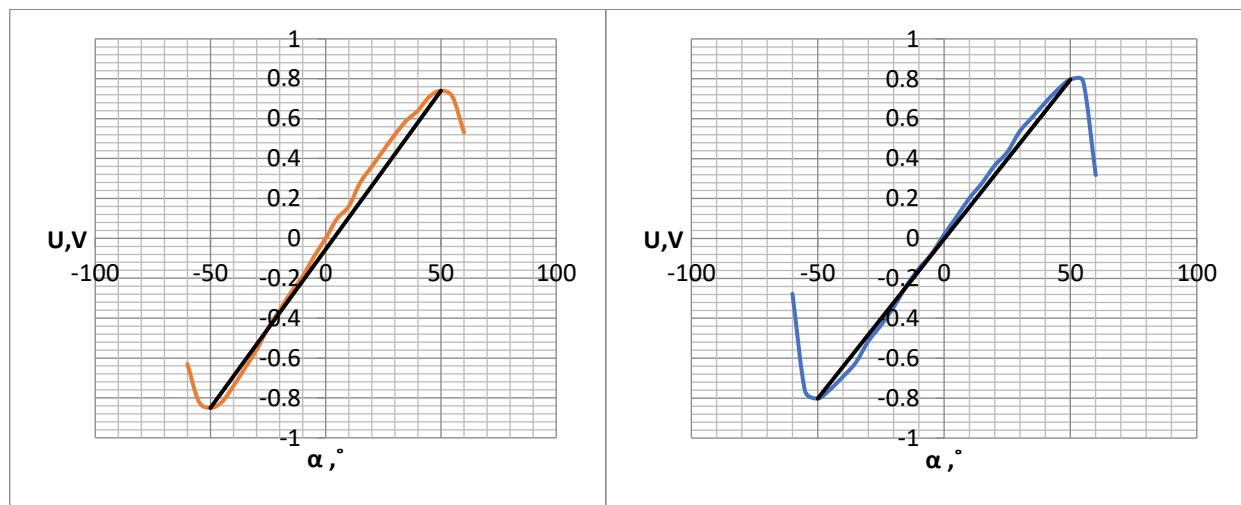


Fig 1. Dependence of differential voltage of working channels of photocells on the angle of inclination of light radiation
a) - sensor mounted on the satellite "PolyItan-2", b) - for the modified sensor.

[1] Yakimenko Y.I., Ivashchuk A.V., Fadeev M.S., Koval V.M., Dusheiko M.G., Kavraska N.M. Research report «Development of 2-coordinate device for determining angular Sun coordinates on nanostructured silicon films for spacecraft», –K., 2017. – 211p.