Designing of New Antenna Stations to the Communication with Low-Orbital Earth Remote Sensing Satellites

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Annotation: **The paper considers the features of aerial station for communication with low-orbit remote sensing satellites based on the Stewart rotary platform. The structure and algorithm of the antenna control system are represented.**

Keywords: **aerial station, Earth remote sensing, control system**.

I. Introduction

Earth remote sensing (ERS) technology from space acts the important part in development of global information technologies, in the creation of the global information systems with the purpose of providing of stable social and economic development, and for safety and defensive of countries.

For wide introduction of the ERS technologies it is necessary to create the hardwares of reception, processing, storage and ERS information transfer **accessible** to the wide users.

Aerial stations (AS) for reception of information from satellite which are the primary ERS data source on Earth (as a rule, they are bulky and massive) are used in the specialized, often military, centers of reception, processing and distribution of the ERS information.

For the effective use of ERS data, it is necessary to bring it closer to the end user. This requires universal compact antenna stations of a consumer class, including mobile ones.

A structure, features of construction, control algorithms and AS designs, with a new type of rotary support devices based on the Stewart platform (Hexapod) are represented in this work.

II. Structure of AS and work algorithm

The problems of the creation of AS for the tracking of satellite for ERS are conditioned by the following factors: the low-orbital satellite trajectories for ERS require the use of high-dynamic rotary support devices for AS with the proper control systems. From other side, the increase of spatial settling ability of image from satellite requires the increase of streams information transmission speed. It is brought to the increase of AS reflector diameter. The mass and construction complication of the precise AS pendant for satellites autotracking increase accordingly. It can cause a dynamic error in angular minutes. The construction and control system of such AS are therefore complicated, and the cost of the station grows.

In addition for the classic rotary support devices (RSD) of “azimuth – elevation” type there are the “dead” areas of satellite autotracking for trajectories near to the zenith (in relation to the location of the ground station).

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The AS construction at which rotary support device consists of the system of 6 parallel linear kinematics links is the six-axial Stewart platform [1], is offered (fig.1). The advantages of such RSD (comparative with circulating mechanisms) are: combination of construction simplicity and compactness, high inflexibility, reliability, technological in construction and service.

The lacks of such RSD are the some limitations on the low angles of reflector slope, and also the complication of simultaneous traffic control of 6 actuators.

Fig.1 AS prototype with RSD of the Stewart platform (Hexapod) based, and the control unit.

In this paper are considered the structure and the work algorithm of the control system which realizes the parallel concerted traffic control of 6 linear actuators, used of the distributed calculation on the programmable logical integrated circuit type FPGA. It is shown the use of affine transformation of coordinates for the transformation of satellite tracking trajectory from the topocentric system of azimuth-elevation coordinates (**R**[t_j,α_j,β_j]) to the local motion coordinates for each actuator (array **R** [t_j,$\alpha1_j$,$\alpha2_j$,$\alpha3_j$,$\alpha4_j$,$\alpha5_j$,$\alpha6_j$]) [2].

III. Conclusions

The offered new AS construction with RSD based of mechanism of the parallel kinematics Hexapod structure has the row of advantages comparative with classic constructions. This construction can be used for creation of the simple “personal” antenna stations for reception of ERS information.

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