Interactive Presentations (IP)
Topic 7 - Interactive Presentations (7)

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HIGH PRECISION SPACE APPLICATION 6-DOF PARALLEL MECHANISM FOR GUIDANCE AND ORIENTATION

Abstract

Modern informational systems that use spacecraft, deal with a wide range of tasks: applied telecommunication problems of providing TV broadcasting; global satellite communication; the Internet; earth surface control; advanced exploration of the near, middle and far space – galaxies, black holes and relict radiation [1 etc.]. To achieve marginal qualitative characteristics of the informational space systems and stations, it is necessary to orient their on-board equipment (antennas, telescopes, reflectors, etc.) towards the spacecraft with the highest precision. Modern requirements for the accuracy of the on-board equipment positioning and orientation of a spacecraft measure in micrometers and micro radians respectively [2]. The basic principle of developing a high-quality positioning and orientation system of an object is feedback control of its position. For the type of pointing devices under consideration, these are three angular and three linear coordinates. Extreme environmental conditions in which the spacecraft equipment operates impose a number of restrictions on the component base used [3]. The accuracy of moving an object placed on a moving platform of a hexapod depends both on the manufacturing errors of the mechanism itself and on correct accounting for all kinematic parameters entered into the mechanism control system for solving the inverse kinematics problem. But first and foremost, the accuracy of movement of the output link - a moving platform with an object - is affected by the accuracy of the linear drives. Due to the drawbacks of the above approaches to building a system for measuring the position and orientation of a mobile platform, as well as in accordance with the modular design principle of the considered mechanism, it is optimal to ensure the functioning of linear drives as closed-loop actuators or servo drives. Thus, current task is to develop a precision parallel kinematics mechanism for space application that can achieve required levels of accuracy, reliability, durability and operation safety. The analysis of the main sources of errors in a hexapod-type mechanism has shown that the greatest impact is made by the manufacturing error of ball screw drives of its linear drives, errors in the positioning and orientation of the joints, as well as linear temperature changes in the dimensions of hexapod elements.