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3D-printing technology for physical simulation of petal-type space mirror deployment.

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To create antennas of large space telescopes, the designs of large transformable mirrors of various types were proposed and developed. The classic design of solid petal type deployable reflector was proposed by Dornier Corporation during "FIRST" space project development ("FIRST" - far infrared space telescope). The same deployment kinematics has been successfully implemented in the design of the 10-meter mirror of Radioastron project, which was launched in 2011 and operates in the centimeter range of the spectrum.

However, there are drawbacks that limit the use of this kinematic scheme to create large deployable mirrors for short waves. Main lacks of the design are as follows:

- After deployment the petals are not tied together by outer loop of the mirror, therefore the rigidity of open reflector is not very high (the geometric rigidity of closed shell did not used)
- Errors in setting the position axes of cylindrical hinges and inaccuracies of petals opening distort the shape of the mirror surface, the value of which increases from the axis of rotation to the periphery of the mirror; however this part of mirror makes a decisive contribution to the effective area of the reflector and for short wave mirror must be made very precise.

Direct calculations and computer model examination shows that the structure remains statically and kinematically determinate in each moment of deployment, if positions of cylindrical hinges are correctly chosen. Therefore the structure remains stress free and geometrically unchangeable in each moment of deployment and precise synchronization for actuators operation during opening is not requires.

3D-printing technology is very useful and flexible instrument for physical simulation of new kinematics for petal type space mirror deployment.

Biography

Victor Bujakas is the leading scientist of P.N. Lebedev Phisical Institute of Russian Academy of Science. He got his PhD from Moscow Peoples' Friendship University, and his honorable PhD from Institute of Control Science of Russian Academy of Science. During several years was leading scientist in Radioastron mission development. In the moment is working in computer and physical simulation of large deployable space structures development. He has published more than 20 papers in reputed journals.

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