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HUMAN-ROBOTIC PARTNERSHIP FOR SPACE EXPLORATION: USING OF ROBOT-ANDROID IN EXTREME SPACE CONDITIONS

Abstract

This paper will present the results of work "Human-robotic cooperation for exploratory tasks" of the Central Research Scientific Institute of Machine Building (TSNIImash, Russia) and Russian Open Joint Stock Company "Android Technic". Human and robotic systems capabilities are quite different that is why it is necessary to investigate how they can cooperate beneficially for future space missions. The main advantage of robots is their ability to operate in hostile environment with proper accuracy. It is evident that without wide use of robotics it is impossible to solve such a global problem as space exploration is. But, field of space robotics is very complex and multilateral. How to choose the most effective variants of robotic infrastructure for future exploratory space missions? This problem is considered in this work. The system analysis approach that allows choosing the more effective variants of robotics content for realizing the strategic goals of manned cosmonautics (utilization of low Earth orbits (LEO); Moon exploration; realization of interplanetary flights to Mars and asteroids; reconnaissance missions to other Solar System planets), is suggested. As a result of the analysis each robotic element is given a priority category according to a level of its usage for each destination. Due to this, it is possible to choose the most perspective combinations of robotic systems for future missions. This paper shows that one of the most perspective ways in robotic segment development is the anthropomorphic type of robots – robot-android. Authors will present the project of First Russian anthropomorphic space robot-android SAR-400. In the presented model based on structure chart, similar to human skeleton, it is implemented the innovative system of interactive controlling. The execute part consists of foundation with two-handed anthropomorphic robot and working zone monitor unit. The control unit is on the operator and it repeats structure chat of manipulators. This robot has vision system that is controlled by operator's head and that provides presence effect. Mobility of manipulator's parts provides high level of maneuverability in the 1.5 meters range. Body turn and swinging increase service zone. Control system and mobility of capture parts provide precise performance of movements given by the operator in the range of 1.5-2 mm. The hand of a setting device forms control signals for gripper and retroactive force-torque relations. The operator perceives assisting forces and it ensures the ability of force regulation.