

SPACE EXPLORATION SYMPOSIUM (A3)
Space Exploration Overview (1)

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USING OF ADVANCED DEVELOPMENTS IN THE FIELD OF TRANSPORT ROBOTICS FOR
DESIGN OF NEXT-GENERATION PLANETARY ROVERS

Abstract

In the last 50 years the development of practical cosmonautics has widen the use of contact methods in researches of heavenly bodies by means of various types of landers, including the mobile ones. It is obvious that humanity will expand its activities further in space and explore it more and more. That means launching of automatic stations and manned expeditions to different planets, their satellites and other space bodies, the establishment of settlements and the creation of artificial satellites and planets with bases for human life. Successful previous usage of planetary rovers allows considering them the advanced spacecraft for further operations on the surfaces of the Moon, Mars and other celestial bodies. The report provides a classification of extraterrestrial rovers, taking into account existing and perspective developments. It includes comparison and analysis of existing control systems of planetary rovers and assumption on further development of these systems. Existing approaches on rovers' movement on a surface and the ones, being under development are provided; their merits and demerits are revealed. The design view of new generation spacecraft is developed. The alternative concept of the device for payload moving on planets' surfaces with low gravitation is under development, the device shall be capable both of movement with constant contact with a surface and with a cyclic contact with the surface. The design of such rover is shown. The mathematical model of rover movement is developed as castellated coupling with pendulum mass motion with an axial suspension in a wheel axis. Energy expenditure when moving with varying speed, elastic properties of system, soil properties are calculated. Development of new generation planetary rovers based on existing and perspective technologies will allow expanding the task range on SC research, transportation and testing on the surfaces of celestial bodies, and also will allow significant power reduction needed for rover movement and delivery to the celestial body surface.