16th IAA SYMPOSIUM ON BUILDING BLOCKS FOR FUTURE SPACE EXPLORATION AND DEVELOPMENT (D3)
Novel Concepts and Technologies to Enable Future Building Blocks in Space Exploration and Development (3)

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SPACE BOK – EXPLORING LEGGED JUMPING LOCOMOTION FOR SPACE EXPLORATION

Abstract

Until now, wheeled locomotion has been the sole form of transportation for robotic exploration on Moon and Mars. While providing high stability and robustness, those systems are limited in their area of operation. Especially in unstructured environments with steep slopes and lose soil, as found on many celestial bodies, wheeled systems reach their limitations. In this context, the use of versatile legged robots

for space exploration presents a valid solution. The flexibility of legged systems allows exploring areas, which up until now have been out of human and robotic reach. Moreover, legged robots allow for the use of gaits with long flight-phases which prove to be more efficient in low-gravity environments. This paper presents the development of Space Bok, a legged jumping robot prototype for space exploration. In the design, the focus of this quadrupedal robot is laid on high efficiency in low-gravity environments. The robot consists of a lightweight carbon main body and four legs with two custom actuators each. Sensing is done using absolute encoders on each actuator and an IMU. The outcome of hardware tests under terrestrial conditions and simulation tests in low-gravity environments are shown and compared to conventional systems.