German Research Center for Artificial Intelligence

LIMES

Learning Intelligent Motions for Cinematically Complex Legged Robots for Exploration in Space

Computer graphic of the test facility for mobile robots (DFKI Space Exploration Hall)

Example morphology for a legged robot with manipulation capabilities

Prototype of the project SpaceClimber climbing in the Space Exploration Hall

Development of a multi-legged walking robot to provide mobility and manipulation capabilities in unstructured and steep environments on surfaces of celestial bodies

In the LIMES project a highly mobile multi-legged walking robot with the ability to straighten up the upper body in order to use the front extremities as manipulation devices will be developed.

In future extraterrestrial missions, such a system will allow taking soil samples from difficult-to-access regions or assembling and maintaining infrastructure on rough and unstructured surfaces of celestial bodies. Beside the mechatronic development of the robot, the project focuses on generating and optimizing different locomotion behaviors for traversing varying surface structures and subsoils with the aid of a simulation environment and machine learning methods.

Extensive sensorial and motor equipment for multifunctional interaction with the environment

Due to their large number of degrees of freedom which are distributed over several extremities, walking robots are able to perform a multitude of different walking patterns and to adapt their posture to the surface structure, in order to maneuver securely and efficiently on rough surfaces. In addition, their manifold sensorial equipment makes a visual as well as a tactile perception of their environment possible, thus enabling them to gain information about the conditions of the substrate they are walking on. On the basis of this knowledge, the best locomotion behavior out of a set of previously optimized behaviors for varying situations can be selected.

The flexible locomotor system furthermore offers the possibility to use the legs for the manipulation of objects, if these are equipped with the appropriate gripping devices. Here too, a multi-modal sensory infrastructure is essential for coping with these tasks.

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