ARAMIES

Ambulating Robot for Autonomous Martian Exploration

Fig. 1: A Martian crater with ice in the Vastitas realis plane ©ESA/DLR

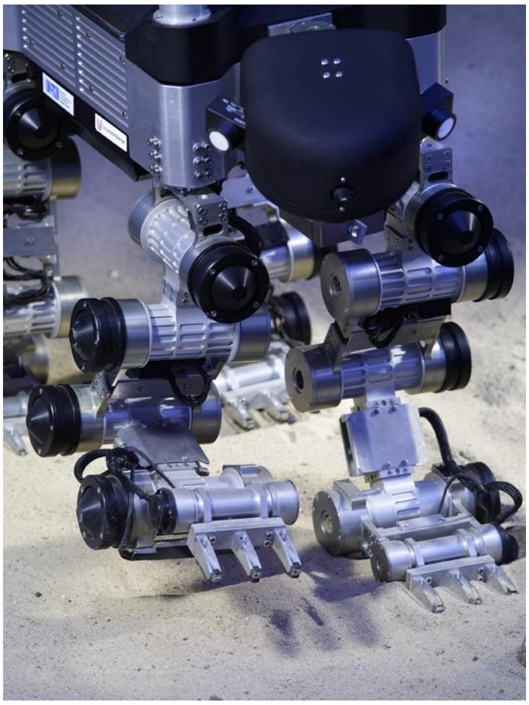

Fig 2: The ARAMIES robot

Walking and Climbing Robot for Future Autonomous Extraterrestrial Exploration

The ARAMIES project deals with developing a walking robot which is capable of autonomous operation in extremely difficult environments, especially very uneven and steep terrain, e.g., the slopes of Martian/lunar canyons or craters. These sites are of high scientific interest.

It is expected that in-situ measurements in the different layers of sediments would give new insights into exobiology and exogeology. Furthermore, it is likely to find frozen water in craters near the pole. Because of their steepness and the rough rocky and sandy terrain, most craters cannot be accessed with the standard wheeled-rover technology.

The ARAMIES robot (fig. 2) comprises 26 active joints, six in each leg and two for actuating the head, which includes a camera, a laser scanner, and two ultrasound distance sensors. The system has acceleration sensors and a gyroscope for stability control. Furthermore, each joint is equipped with absolute position sensors, current sensors, and temperature sensors.

One major advantage of the ARAMIES robot in comparison to other walking robots is its actuated claw (fig. 2) which is used to find hold in steep inclinations. In laboratory tests, the system was able to climb up a rung wall with an inclination of 70°.

The modular control and power hardware consists of a PC 104 system for high-level control (e.g. navigation & planning), a MPC 565/FPGA board for the reactive behavior-based control, and five FPGA-controlled motor boards.

The software is based on bio-inspired locomotion control concepts. It features Central Pattern Generator (CPG) and reflex models. The bio-inspired mechanisms allow to solve the problem of controlling simultaneously 26 joints with high reactivity. This is achieved by a very low number of arithmetic operations providing high-energy efficiency in comparison to standard model-based robotic control approaches.

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