Paper ID: 2570
student

38th STUDENT CONFERENCE (E2)
Student Conference II (2)

Author: Mr. Miklos Vincze
Eötvös Loránd University, Hungary, vincze.m@gmail.com

NEW BIO-INSPIRED TECHNIQUES FOR PLANETARY SURFACE EXPLORATION

Abstract

Evolution's 'trial and error' mechanism definitly lead to the best and most economic biological structures within given environmental circumstances. Therefore if one designs a complex system, in some cases it can be useful to learn what kind of solutions had nature come up with for a similar problem among similar conditions. This new approach in engineering (or rather reverse-engineering) is often referred to as 'biomimetics'. Biomimetics can be applied within a wide range of space-related fields, e.g. materials science, sensor designing or operation-optimalization.

In the automatic planetary missions of the near future, mobility on the surface will play a key role. Out of the classical wheeled rovers, which are tending to get more and more complex there will be need for simple, small and autonomous 'nano-robots' as well. These would not depend on remote guidance at all, and would not hold more than one or two scientific instruments, but it would be possible to create a large network of these small units and hence to understand some larger-scale phenomena of the planet.

A conceptual study is presented for a hypothetic Mars or Titan mission, which involves many bio-inspired ideas. From an atmospheric glider or baloon small landers are dropped to the surface using a one-winged rotating braking system, inspired by maple seeds. The parameters and effectiveness of such a landing method are discussed for both types of atmospheric environment. After the landing, four simple autonomous snake-robots (or 'snakebots' according to the NASA terminology) are released from each maple-seed lander. The sidewinding motions of Sahara desert vipers are studied to find the optimal way of locomotion for the snakebots. The decision-making algorithm of the autonomous guidance is based on a method learned from the behaviour of E. Coli bacteria. Bio-inspired digging mechanisms are also described. The size and distribution of such a randomly evolving network is analysed, and the possible scientific usage of the system as a meteorological, heatflow or seismological network is discussed.