

## **03/6201 Biologically inspired solutions for robotic surface mobility**

**Type of activity: Medium Study (4 months, 25 KEUR)**

The possible advantages of biomimetic locomotion are a robust response to obstacles, the ability to position the body of the robot to a high degree of accuracy, and rapid movement over complex and unpredictable terrain. Wheeled vehicles are obviously superior when the terrain is relatively smooth, but have difficulties when encountering natural uneven terrains with many substrates. Legged animals can traverse such environments rapidly (insect legs commonly have over eight degrees of freedom), an observation that encourages the development of biomimetic legged vehicles. Nevertheless it should be acknowledged that extensive work has already been done in this field, and therefore also alternatives to robotic ambulation should be considered.

### **Study Objectives**

The application of biomimetic locomotion to the martian surface offers the possibility of increased robustness and failure tolerance. Identification and development of promising novel techniques of locomotion in planetary environments is therefore a priority. This study will involve the identification and conceptual development of one or more innovative concepts for planetary surface locomotion. The correct mode of locomotion is obviously environment-dependent, and the suitability of proposed techniques must be justified in the context of the environment in which they will operate. Furthermore, investigation of the utilisation of already-present environmental features to aid the locomotion is encouraged (for example, ambulatory robots obviously use the ground to aid locomotion: another possibility on meteorologically active planets such as Mars is the use of ground-level winds to propel the robot).

In summary the study objectives are:

- Identification and development of promising novel techniques of locomotion in planetary environments. Because ambulatory concepts have already been well studied, the focus is encouraged towards more novel concepts
- Justification of the identified concepts in the context of the environment in which they will operate. In particular, an emphasis on utilising the coupling between the locomotive device and the environment.

### **References**

[1] Dickinson, M. H., Farley, C. T., Full, R. J., Keohl, M. A. R., Kram, R., Lehman, S. (2000). How Animals Move: An integrative View. *Science* 288 (7th April) 100-106.

[2] Quinn, R. D., Nelson, G. M., Ritzmann, R. E. (2002) Towards the development of agile and mission-capable legged robots. *Neurotechnology for biomimetic robots*, MIT Press.