Exploiting frictional anisotropy from a passive scale-like material for energy-efficient locomotion of a bio-inspired walking robot

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Abstract:

Locomotion efficiency on rough surfaces is nontrivial; it can, however, be achieved or improved by employing the concepts of frictional anisotropy and mechanical interlocking between surfaces at the microscale. In principle, strong mechanical interlocking in one direction will allow a robot to grip the surface, thereby preventing it from slipping or sliding backward, while almost no mechanical interlocking in another direction will allow it to easily release itself from the surface while moving forward. In this talk, I will present how exploit frictional anisotropy of a passive scale-like material (shark skin) can be exploited to enhance grip and locomotion of a bio-inspired walking robot. The robot experimental results show that the material can allow the robot to efficiently walk up different slope angles with different surfaces without the need for any sensory feedback, modifying our existing locomotion control, or even redesigning our robot structures. This approach can guide the development of new types of material for future biomimetic applications.

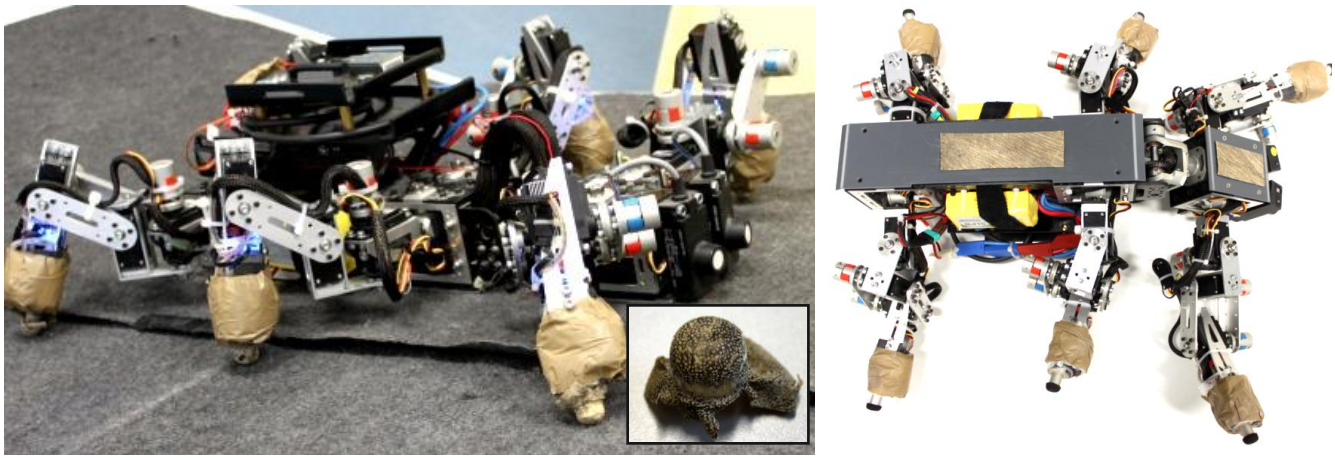

Figure 1: Left, the bio-inspired hexapod robot AMOSII with shark skin feet (inset). Right, AMOSII with shark skin at its belly. All pictures are adapted from Manoonpong et al. Scientific Reports, 2016.

Reference:

Manoonpong, P.; Petersen, D.; Kovalev, A.; Woergoetter, F.; Gorb, S.; Spinner, M.; Heepe, L. (2016) Enhanced Locomotion Efficiency of a Bio-inspired Walking Robot using Contact Surfaces with Frictional Anisotropy, Scientific Reports 6(39455) doi:10.1038/srep39455, Nature Publishing