

Learning to move with modular robots using central pattern generators and online optimization

Auke Jan Ijspeert, EPFL

Auke.Ijspeert@epfl.ch

<http://birg.epfl.ch> & <http://birg.epfl.ch/page53469.html>

Abstract:

This talk addresses the problem of how modular robotics systems, i.e. systems composed of multiple modules that can be configured into different robotic structures, can learn to move. In particular, we tackle the problems of online learning, that is, learning while moving, and the problem of dealing with unknown arbitrary robotic structures. To tackle those problems we propose a framework for learning locomotion controllers based on two components: a central pattern generator and a gradient-free optimization algorithm: Powell's method. Biological central pattern generators (CPGs) are distributed neural circuits found in both invertebrate and vertebrate animals that can produce coordinated patterns of rhythmic activity while being modulated by simple control parameters. We will show how a CPG implemented as a distributed system of coupled nonlinear oscillators can be an ideal substrate for online learning and for controlling a modular and reconfigurable robotic system.

This work is done in collaboration with Alexander Sproewitz, Rico Moeckel, and Jerome Maye.