Universität Stuttgart

Institut für
Nichtlineare Mechanik

Masterarbeit

Investigating the Origin of Gaits

Despite being built very differently, many mammals use exactly the same set of gaits. Dogs, for example walk at low speed, trot at intermediate speeds, and run at high speeds. The same is true for cats, horses, giraffes, or bison just to name a few animals with very different morphology. A similar pattern can be observed in bipeds: both, humans and birds, tend to walk at low speeds and run at high speeds. Even for legged robots it has been shown that these common gaits are the most efficient way to move around. However, up to today, nobody knows why (despite the obvious differences between these legged systems) the same gaits emerge in all of them. An potential explanation is that the different gaits are a manifestation of the passive mechanical dynamics that are inherent to a legged system. Investigating this hypothesis, this project studies limit cycles and nonlinear modes in conceptual models of legged systems, and examines how these limit cycles relate to different gaits.

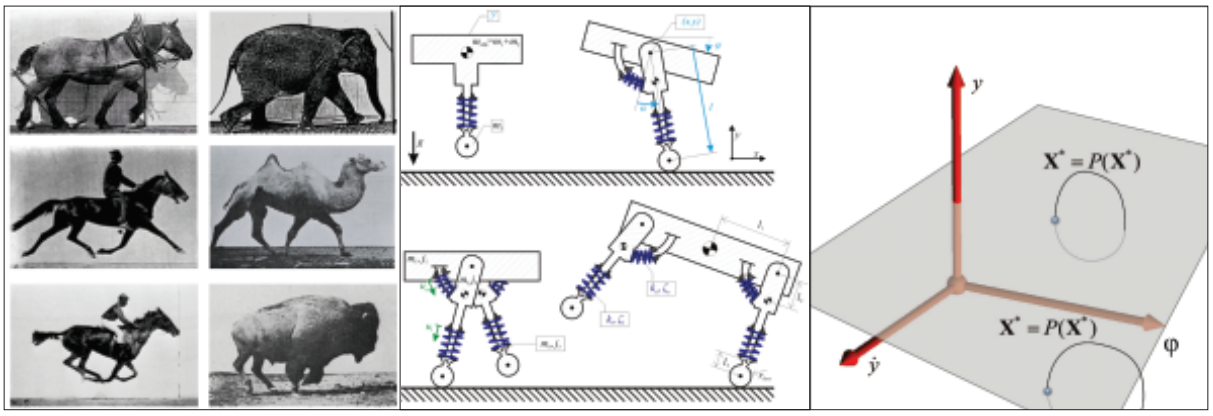

Abbildung 1: Can simple mechanical models explain the origin of different gaits?

Using numerical tools for dynamic simulation and continuation, you will investigate the motion of passive models of legged systems that are able to exhibit a large variety of different modes. We will also study a limiting case, in which the model of a legged robot gradually converges towards this passive system in order to understand if the passive limit cycles are reflected in its gaits.
This project will be conducted in collaboration with the Robotics and Motion Laboratory at the University of Michigan (`http://ram-lab.engin.umich.edu/`) and it is expected that you will spend part of your time on-site in Ann Arbor, Michigan. A stipend will cover the costs of your flight.

Themengebiete:	Nonlinear Dynamics, Limit Cycles, Bifurcations
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Verantwortlicher Professor:	Prof. Dr. Leine
Vorkenntnisse:	Dynamik mechanischer Systeme, Nichtlineare Dynamik mechanischer Systeme, Matlab