

Morphological computation in neuromechanical control of movement

Daniel Häufle, University of Tübingen

Abstract:

Our research goal is to understand how the different hierarchical levels of the neuronal network interact with the musculoskeletal system to form a closed-loop system generating movement. In particular, we are very interested in how the muscle dynamics influence and simplify human motor control. For this, our unique research expertise is the development methods to quantify what is commonly referred to as Embodiment or Morphological Computation. Both represent the notion that the neuronal system interacts with the environment through its body, which, in consequence, shapes human behavior. We quantify this contribution of the morphology with the help of mathematical models and forward-dynamic computer simulations of the sensorimotor system. I will show our work on reduced mechanistic models and our recent approaches to tackle complex dynamic behaviours with reinforcement learning approaches. Furthermore, I will give an outlook on applications of our methods in neurorehabilitation and the design of assistive devices.