OSS12-2012-020009

Abstract for an Invited Paper
for the OSS12 Meeting of
the American Physical Society

Animal Gaits and Symmetry

MARTIN GOLUBITSKY, Mathematical Biosciences Institute, Ohio State University

Many gaits of four-legged animals are described by symmetry. For example, when a horse paces it moves both left legs in unison and then both right legs and so on. The motion is described by two symmetries: Interchange front and back legs, and swap left and right legs with a half-period phase shift. Biologists postulate the existence of a central pattern generator (CPG) in the neuronal system that sends periodic signals to the legs. CPGs can be thought of as electrical circuits that produce periodic signals and can be modeled by systems with symmetry. In this lecture we discuss animal gaits; use gait symmetries to construct a simplest CPG architecture that naturally produces quadrupedal gait rhythms; and make several testable predictions about gaits.