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Compliant Synergies in Locomotion MATTHEW TRAVERS, HOWIE CHOSET, Carnegie Mellon University, GOLDMAN @ GEORGIA TECH. PHYSICS DEPARTMENT COLLABORATION — Biological systems appear to have natural mechanisms that allow them to readily compensate for unexpected environmental variations when compared to their mechanical (i.e., robotic) counterparts. We hypothesize that the basis for this discrepancy is almost innate: what biology appears to be born with, built-in mechanisms for coordinating their many degrees of freedom, we struggle to "program." We therefore look toward biology for inspiration. In particular, we are interested in kinematic synergies, low-dimensional representations that explicitly encode the underlying structure of how systems coordinate their internal degrees of freedom to achieve high-level tasks. In this work, we derive parametric representations of kinematic synergies and present a new compliant locomotion control framework that enables the parameters to be directly controlled in response to external disturbances. We present results of this framework implemented on two separate platforms, a snake-like and hexapod robot. Our results show that, using synergies, the locomotion control of these very different systems can be reduced to simple, extremely capable, and common forms, thus offering new insights into both robotic as well as biological locomotion in complex terrains.

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