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The Effects of Internal Damping on Locomotion in Frictional Environments[1] BRIAN VAN STRATUM, JONATHAN CLARK, KOUROSH SHOELE, Florida State University — The periodic motion or gaits of undulating animals arise as the result of a complex interaction of their central nervous system, muscle and connective tissue, bone, and their environment. Previous studies have assumed that sufficient internal force necessary to produce observed kinematics are always achievable, thus not focusing on an understanding of the connection between force production in the crawling animals and their locomotion performance. For soft robotic applications, internal damping is a parameter in the designer's control, the effect of which is not well understood. We study how the internal damping affects the locomotion performance of a crawler with a continuous, visco-elastic, nonlinear beam model. Crawler muscle actuation is modeled as a traveling wave of bending moment that propagates posteriorly along the body. Consistent with the friction properties of the scales of snakes and limbless lizards, environmental forces are modeled using anisotropic Coulomb friction. We find that by varying the crawler body's internal damping, the performance of the crawler can be altered and distinct gaits emerge. Indeed, we find that crawling direction can be changed by appropriate control of internal damping. Further, we identify the parameters that produce optimal gaits.

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