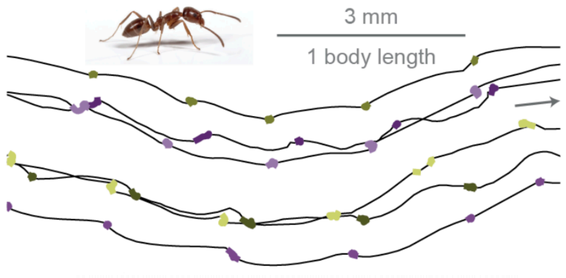
Ants Behaviors Exhibit Stokesian Qualities

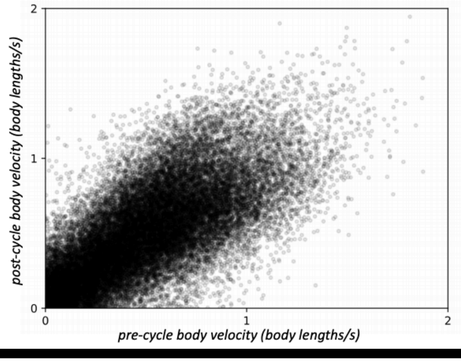
Brian Bittner[1], Glenna Clifton[2], Dan Zhao[1], Nick Gravish[3], Shai Revzen[1]
babitt@umich.edu

Abstract

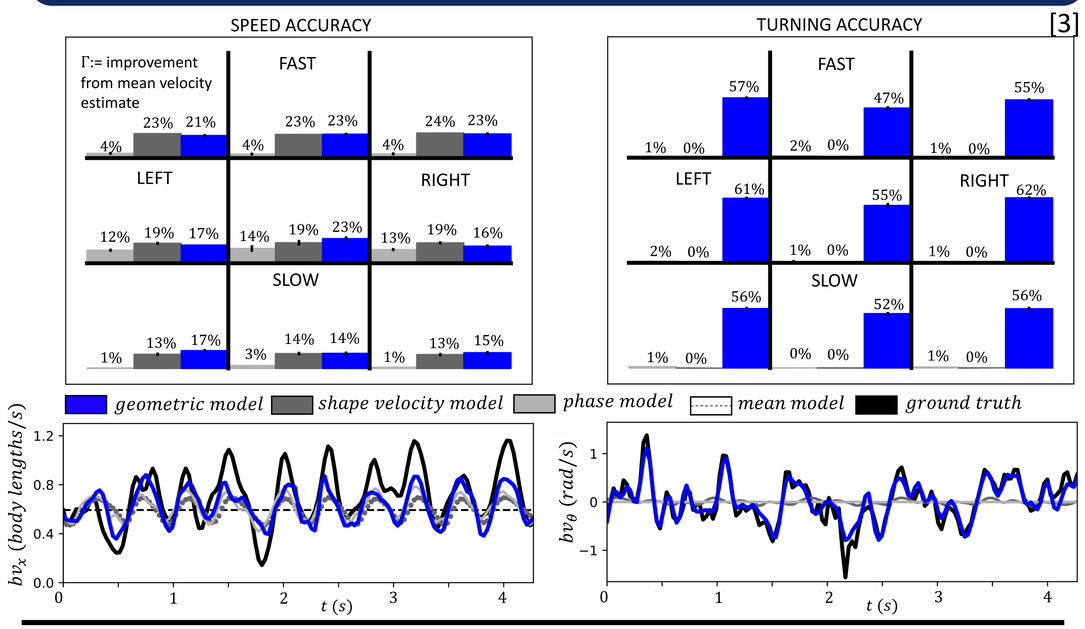
Legged locomotion, the most prevalent mode of terrestrial locomotion, involves the frequent making and breaking of contacts. These discrete events can make it challenging to have simple yet descriptive behavioral models. Motions that exhibit continuous contact often result in simpler representations. Such is the case for slithering systems like snakes. For these systems, analysis via observation and resistive force theory shows that frictional forces dominate those caused by inertia, constraining the motion to Stokesian behavior [1]. In our studies, we have found through qualitative and quantitative descriptors that ants, despite their fundamentally hybrid qualities, function as dynamical analogues to the friction dominated behaviors of continuous Stokesian movers. We make three arguments (**A1**, **A2**, **A3**) that support this hypothesis that ants are Stokesian walkers.

A1: Ants Rarely Slip and Exhibit Strong Velocity Control



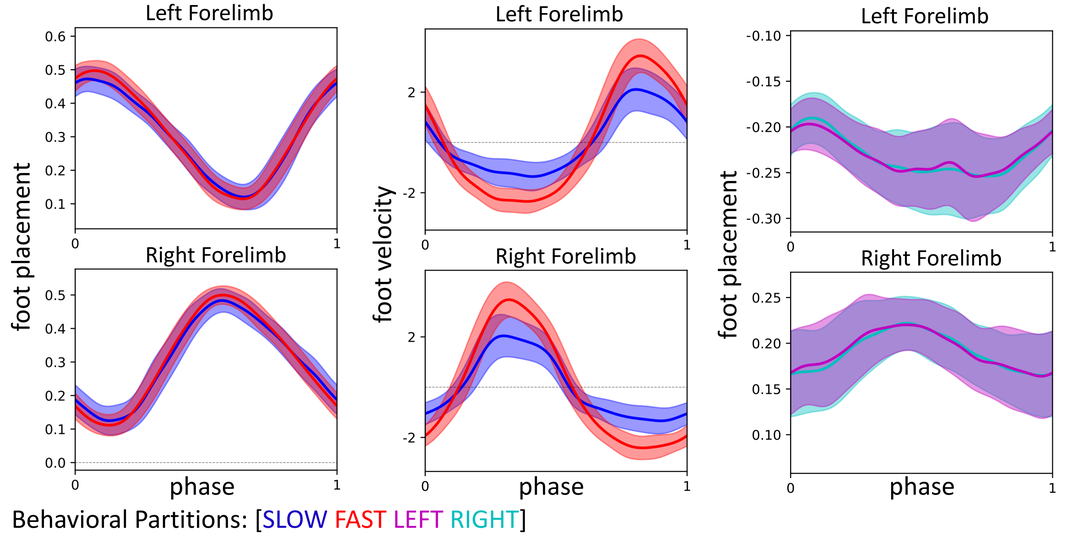


A2: Data Driven Stokesian Models Can Predict Turning, Speed-Ups, and Slow-Downs



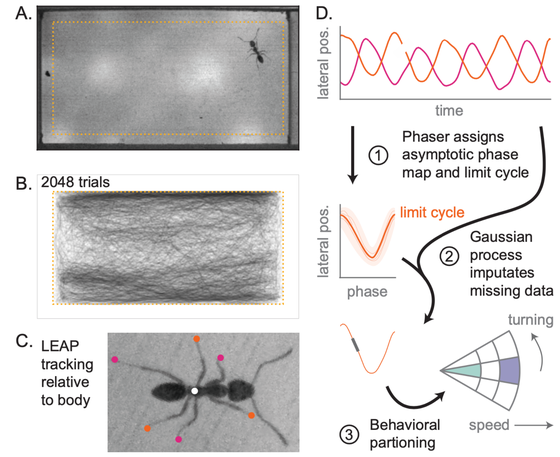
[3]

A3: Stride Speed Varies More Noticeably than Stride Shape with Respect to Body Speed Changes [2]



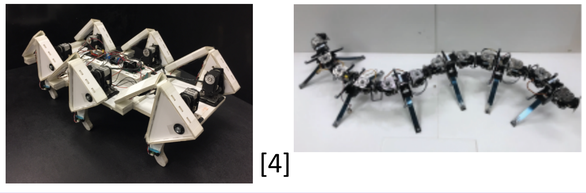
Behavioral Partitions: [SLOW FAST LEFT RIGHT]

Processing Walking Data



Future Work

Could Stokesian models play a role in macro-scale legged locomotion?



[4]

References

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[2] Clifton, G. T., D. Holway, and N. Gravish. "Uneven substrates constrain walking speed in ants through modulation of stride frequency more than stride length." *Royal Society open science* 7.3 (2020): 192068. https://doi.org/10.1098/rsos.192068
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