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Task driven optimal leg trajectories in insect-scale legged microrobots NEEL DOSHI, BENJAMIN GOLDBERG, KAUSHIK JAYARAM, ROBERT WOOD, Harvard University — Origami inspired layered manufacturing techniques and 3D-printing have enabled the development of highly articulated legged robots at the insect-scale, including the 1.43g Harvard Ambulatory MicroRobot (HAMR). Research on these platforms has expanded its focus from manufacturing aspects to include design optimization and control for application-driven tasks. Consequently, the choice of gait selection, body morphology, leg trajectory, foot design, etc. have become areas of active research. HAMR has two controlled degrees-of-freedom per leg, making it an ideal candidate for exploring leg trajectory. We will discuss our work towards optimizing HAMRs leg trajectories for two different tasks: climbing using electroadhesives and level ground running (5-10 BL/s). These tasks demonstrate the ability of single platform to adapt to vastly different locomotive scenarios: quasi-static climbing with controlled ground contact, and dynamic running with un-controlled ground contact. We will utilize trajectory optimization methods informed by existing models and experimental studies to determine leg trajectories for each task. We also plan to discuss how task specifications and choice of objective function have contributed to the shape of these optimal leg trajectories.

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