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Phase Helps Find Geometrically Optimal Gaits[1] SHAI REVZEN, University of Michigan, ROSS HATTON, Oregon State University — Geometric motion planning describes motions of animals and machines governed by $\dot{g} = gA(q)\dot{q}$ – a connection $A(\cdot)$ relating shape q and shape velocity $\dot{q}$ to body frame velocity $g^{-1}\dot{g} \in \mathrm{se}(3)$. Measuring the entire connection over a multidimensional q is often unfeasible with current experimental methods. We show how using a phase estimator can make tractable measuring the local structure of the connection surrounding a periodic motion $q(\varphi)$ driven by a phase $\varphi \in \mathsf{S}^1$. This approach reduces the complexity of the estimation problem by a factor of $\dim q$. The results suggest that phase estimation can be combined with geometric optimization into an iterative gait optimization algorithm usable on experimental systems, or alternatively, to allow the geometric optimality of an observed gait to be detected.

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