Algorithmic Gait Synthesis for a Snake Robot

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Abstract

- Snake robots are articulated and slender which allows them to reach confined spaces and makes them great candidates for amphibious locomotion
- Mimicking gaits found in nature has been effective for simple environments but little work has been on generating gait pattern algorithmically

Snake and Environment Force Models

- We consider snake robots both on land and in water with both low and moderate Reynolds number flow regimes

Algorithmic Gait Synthesis

- The problem of gait synthesis can be viewed as a planning problem where we compute a sequence of robot actions which result in desired robot state
- We employ different classes of planning algorithms both offline and online - RRT (sampling based planning), iLQG (model predictive control) and Proximal Policy Optimization (model-free RL)

Results

- Kinodynamic RRT and PPO require offline computation (Fig. 3 & Fig. 4)
- While the trajectories obtained from RRT (Fig. 5) are inefficient, trajectories from iLQG and PPO with same cost/reward result in gaits which closely resemble those found in nature (Fig. 6)
- The performance of the three planning algorithms in terms of time and energy is compared (Fig. 7)