Simplifying Control Through Active Tail Use

Simulation Results

Open- and Closed-Loop Hopping with different Morphologies

Components:
- Flywheel
- Long, Light Tail
- Short, Heavy Tail

Models with lighter tails are much more robust to disturbances to body-pitching.

Simulation of models with the same tail moment of inertia but different mass.

Hardware Results

Cheetah-Cub Blue robot, courtesy Massimo Vespignani

We tested tail effectiveness using the Cheetah-Cub, a cat-inspired robot using a bounding gait. Performance was compared using tails with the same moment of inertia but different mass. Using a light tail, performance is much less sensitive to configuration changes.

Open Questions

- Consequences of Scaling?
  Our simplistic analysis suggests that force-requirements, and therefore muscle-mass dedicated to the tail, scale with positive allometry.

- The Coupled Case?
  We focused on the advantages of decoupled-dynamics for simpler control. How could the coupling itself be exploited? How to balance the advantages?

- Agile vs Steady?
  We focused on very dynamic locomotion (high Froude numbers). Do slower animals do the same thing?

Hardware Results

- Forward Velocity [m/s]
  - Heavy Tail
  - Light Tail
  - Passive Tail

- Body Pitching [deg]
  - Heavy Tail
  - Light Tail
  - Passive Tail

For a more in-depth study on scaling of tails, visit the talk “Scaling of Effectiveness for Inertial Reorientation”!
Tuesday 6th, 13:45, Room 1D, Thomas Libby*, A.M. Johnson, R.J. Full

T. Rex, courtesy skeletalDrawing.blogspot.com

Pangolin courtesy gviSouthAfrica.blogspot.com

Snow Leopard courtesy SnowLeopardConservancy.org

For models with the same tail moment of inertia but different mass.

Simulations of models with the same tail moment of inertia but different mass. Models with lighter tails are much more robust to disturbances to body-pitching.

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