Reactive coordination: stabilizing common quadrupedal gaits without CPGs

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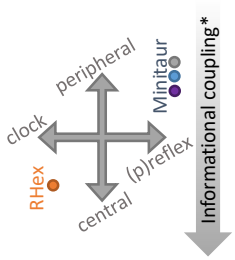
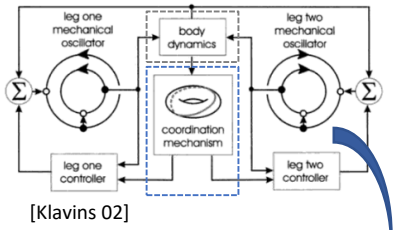
Overview

Background: Clocked (CPG) vs. Reflex

- [Klavins 02] compares two strategies on two simple models
- Uncovers "the value of feedback as a hedge against environmental uncertainty"
- Suggests two axes of exploration (**left**)
- General structure of reflex coordination (**right**)

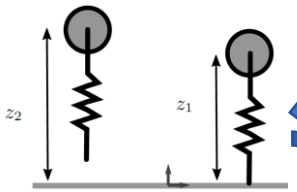




[Klavins 02]

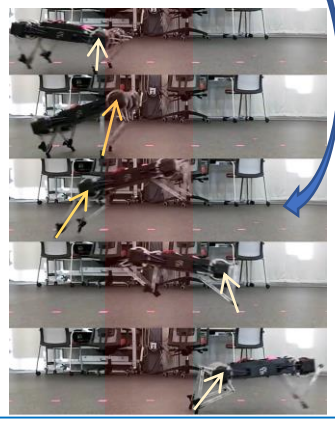
New agenda: template composition

- Templates are "peripheral" dynamical systems
- Flexible methodology for gait synthesis

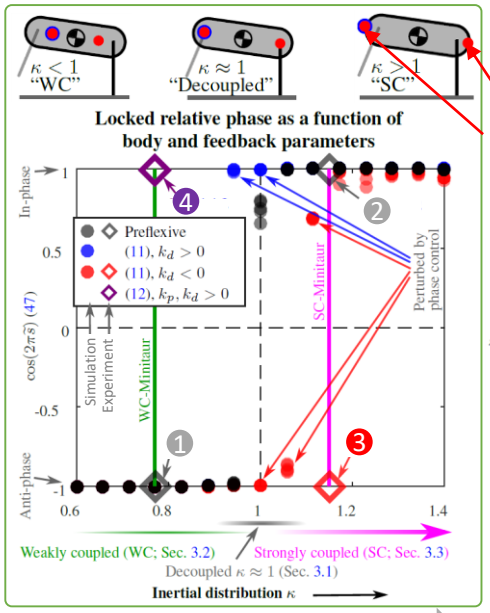


New application: virtual bipedal quadruped gaits

- Controllers designed on vertical hopper(s)
- Tuning at the template level
- E.g. leaping while running (**right**) accomplished by template energization (no centralized tuning nor coordination required)

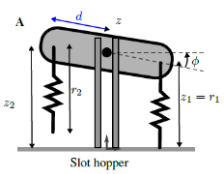


Methods and Results



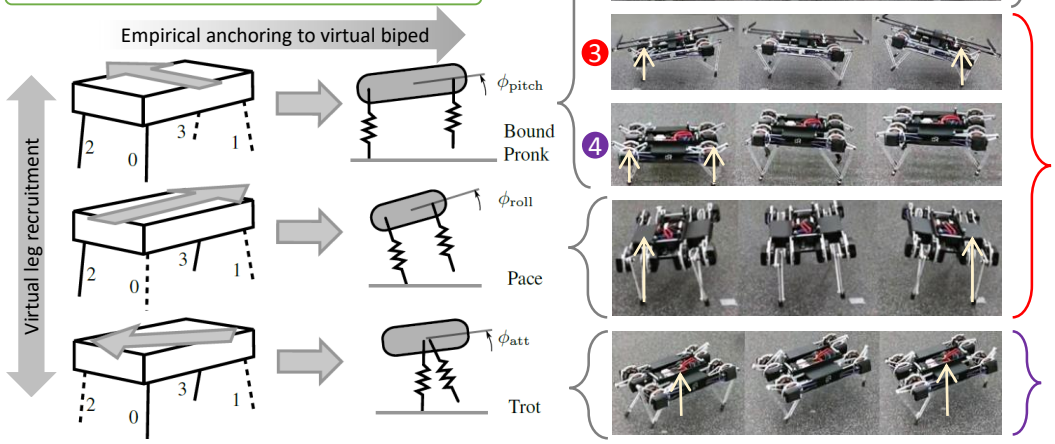
New coordination: phase/attitude control

- Only "centralized" sensor information is body attitude
- Changes frequency of individual hopper
- Shown as ●●●, preflexive ● (**left**)



New template for preflexive coordination: slot hopper (left)

- Exhibits 2 types of preflexive coordination
- Key parameter: non-dimensional inertia
- Analytical stability proofs



References

[Klavins 02] E. Klavins, H. Komsuoglu, R. J. Full, and D. E. Koditschek, "The Role of Reflexes versus Central Pattern Generators in Dynamical Legged Locomotion," in Neurotechnology for Biomimetic Robots, MIT Press, Cambridge, MA, 2002, pp. 351–382.