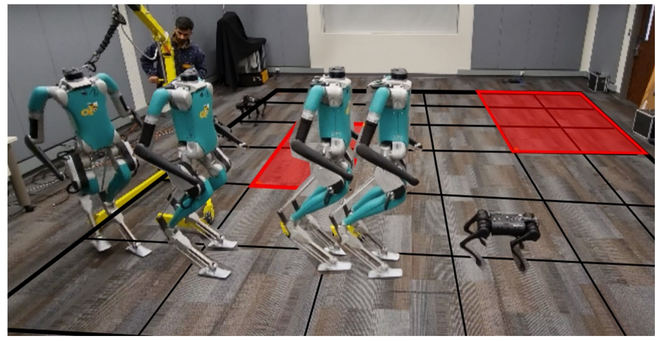
NRI: FND: Robust and Scalable Planning for Agile and Collaborative Robot Teammates in Complex Environments

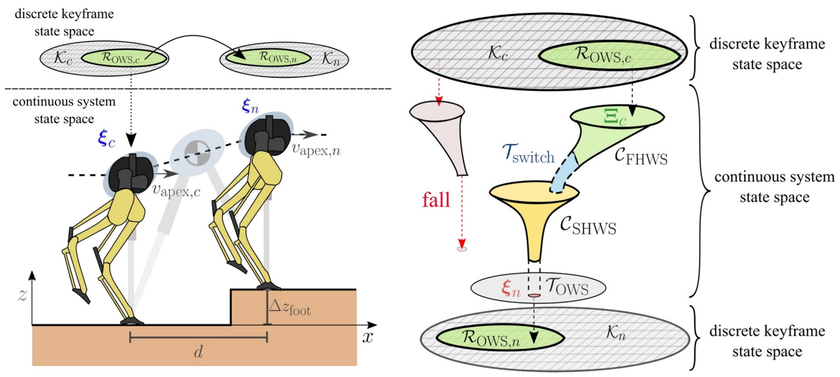
Ye Zhao (PI, Georgia Tech), Sam Coogan (co-PI, Georgia Tech)
Laboratory for Intelligent Decision and Autonomous Robots
Formal Methods & Autonomous Control of Transportation Systems Lab

Project goal: "Whole-System Decision and Planning" of heterogeneous and ubiquitous co-robots with robustness and safety guarantees

Thrust 1: Robust and safe planning for dynamic non-periodic locomotion

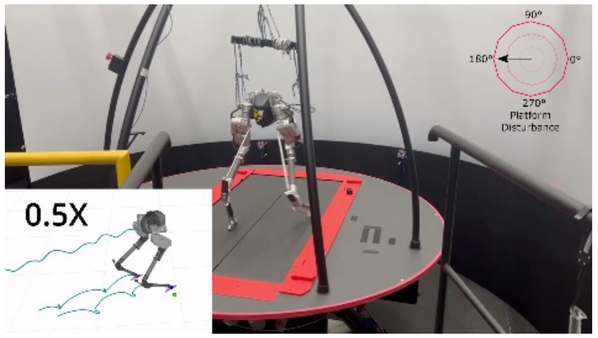


- Temporal-logic based task specification in adversarial scenes
- Belief tracking of dynamic obstacles [CDC 2020]
- Sequential composition of template models via game-based reactive synthesis [IJRR 2022]



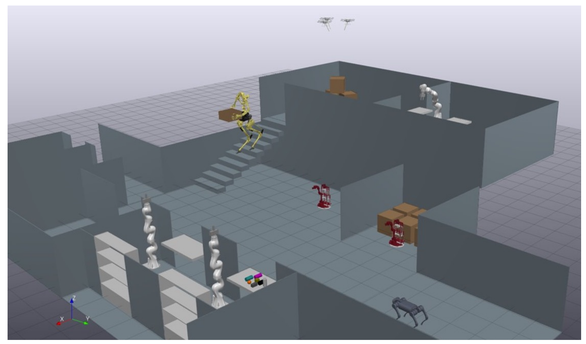
- Reachability phase-space region computation for robust locomotion in the presence of external perturbations
- Simultaneous balancing and navigation safety [TRO, In revision]

Thrust 2: Real-time planning resilient to anytime perturbations



- Real-time push recovery resilient to Anytime perturbations through behavior tree [ICRA 2022]
- Safe leg crossing motion with collision-free guarantee

Thrust 3: Scalable and safe mission and task planning of heterogeneous robot teaming



- Collision avoidance + contact-rich tasks
- Task allocation with formal guarantees [CASE 2022]

Thrust 4: Terrestrial and aerial coordination for environmental conflict resolution

- An agent may encounter unmodeled environmental failures that requires runtime synthesis and enforcement [SSRR 2022]
- Resolve unexpected failures through other agent's assistance

Scientific and Broader Impact

- Our Vertically Integrated Project (VIP) team at Georgia Tech won **2020 AIM Best Late Breaking Results Poster Award**.
- The VIP team won **2021 and 2022 First place in the Robotics Track of the GaTech VIP Innovation Competition.**
- ENGAGES students won **Outstanding Exhibit Award** in STEM at the YSEA Science Fair.

2023 FRR-NRI Principal Investigators' Meeting
May 2-3, 2023

Georgia Tech

Award ID#: 1924978
Award Date: September 1st 2019