NRI: FND: COLLAB: Design of dynamic multibehavioral robots: new tools to consider design tradeoff and enable more capable robotic systems

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How do we design a robot that is good at multiple behaviors?
Consider the mobile manipulators shown at right. Each has mobility and manipulation subsystems that are designed entirely independently. How can we generate more synergistic designs, and reason about their tradeoffs?

Key Challenges:

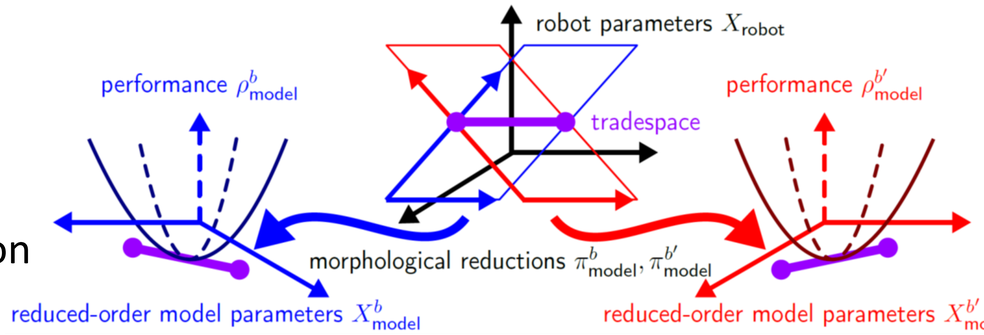
- High dimensional design and performance spaces
- Conflicting design objectives
- Encoding engineering constraints
- Nonsmooth dynamics of contact

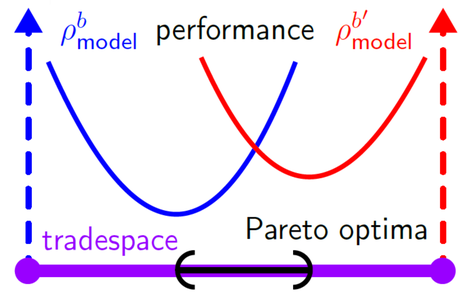
Scientific Impact:

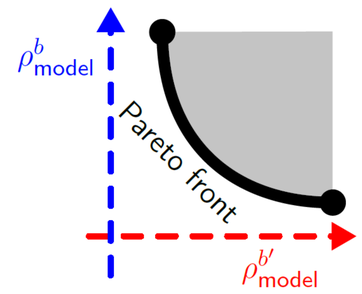
The analytical and computational techniques we create will contribute toward establishing a systematic paradigm for robot design, addressing NRI 2.0 themes of **Customizability** and **Lowering Barriers to Entry.**

Approach:

Lift reduced-order model performances to a common design parameter tradespace, then use techniques from Pareto optimization to navigate that tradespace.







Broader Impact:

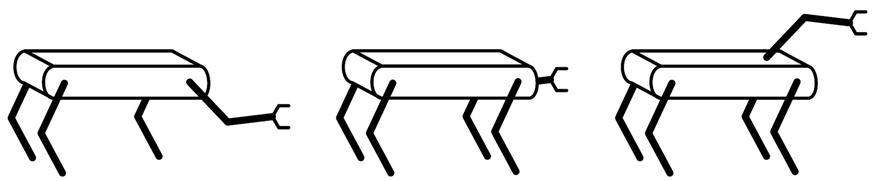
Design for multibehaviorality will help produce home assistance robots that operate in human environments and must have the flexibility to travel up stairs, over clutter, dig through drawers, manipulate small objects, etc.

Education:

This research will be integrated into the PI's teaching (*CMU Robot Design and experimentation* class) and outreach (*UW Discovery Days*) activities. A workshop on multibehaviorality in robotics and biology is forthcoming.

Case Study:

How to best design a fetching co-robot? Consider integrating manipulation on an arm, leg, or body of a mobile robot.



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