NRI/Collaborative Research: Robust Design and Reliable Autonomy for Transforming Modular Hybrid Rigid-Soft Robots

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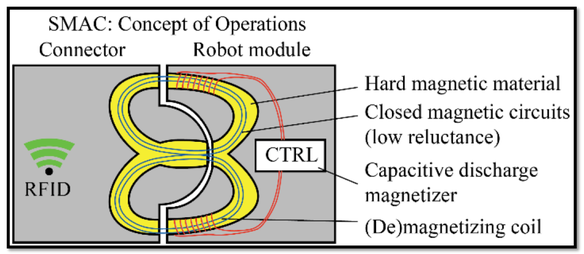
This project aims to advance the state of the art in the theory and practice of soft robots by creating novel physical hardware designs incorporating both stiff and soft elements to offset limitations of each individual technology, with the goal of overcoming operational, locomotion, reliability, control, and autonomy challenges posed by harsh environments.

Key Challenges

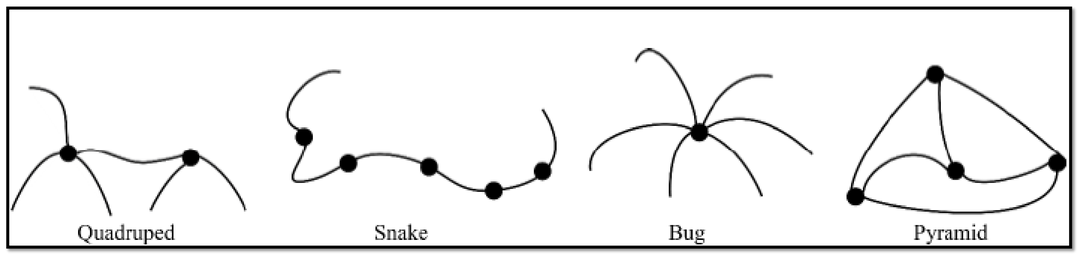
- Combine the advantages of rigid robots and soft robots, which are environmentally sealed yet topologically reconfigurable.
- Coordination of large numbers of both actuated and passive DoF in hybrid rigid-soft systems to provide robustness and reliability for non-collocated human-robot teams

Scientific and Technological Impact

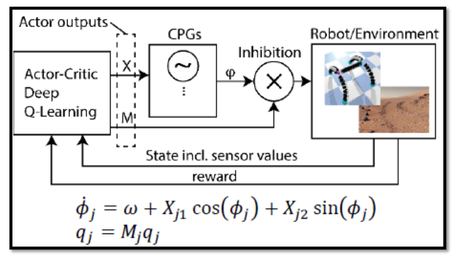
- New methods for modular robot connection and disconnection
- Physics-based simulation for discovery of compensatory gaits following module failure
- New methods for self-monitoring and redundancy in modular soft robots



Switchable MAgnetic Connector (SMAC)



Proposed modular soft robot topologies



Learning-CPG locomotion

Impacted Application Areas

- Scientific exploration
- Search and rescue
- Inspection
- Surveillance and reconnaissance

Education & Outreach

- 10 min tutorial YouTube videos will be released https://bit.ly/3uBaV7z
- Building a snake-like soft robot outreach events

Broader Impacts

- Enable soft robots to “leave the laboratory” and explore environments ranging from -100 to +100 C, 0-1 atm, and 10g accelerations

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