Co-Robotic Systems for GeoSciences Field Research

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THE CHALLENGE

Locomotion in sand

Science exploration HRI

Complex sediment transport processes

SCIENTIFIC & BROADER IMPACTS

This work anticipates a near future where humans and robots operate in coordination to explore, collect data, and test hypotheses on Earth, other planets.

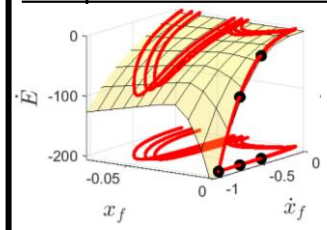
Our novel approach:

- Direct-drive robotic leg to allow precise measure of soil strength and environment-aided locomotion
- Multi robot team to help human scientists isolate and model dependence of soil strength on different environment controls
- Simulated decision making scenario to explore human sampling strategies, increase autonomy, and enhance scientific practice

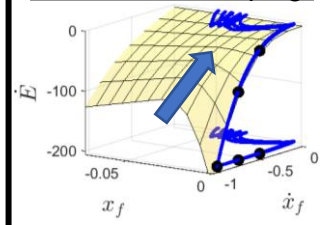
THE SOLUTION

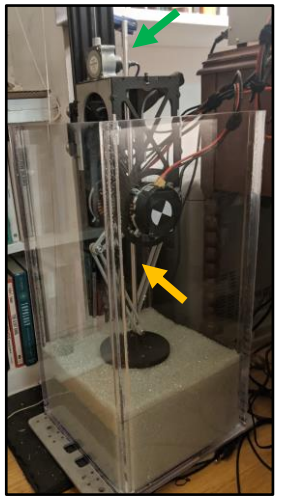
Locomotion in sand

Compression-extension:



With "active damping":





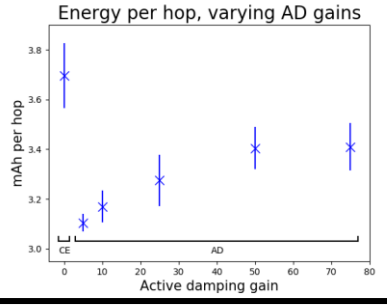
Method:

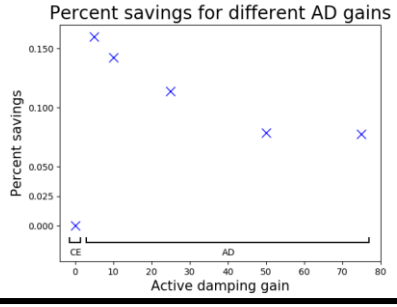
Glass beads (3.4 mm) w/ volume frac. limited to 0.61 to 0.63

Robot jumps on linear rail

3D printed large foot attached to vertical rod

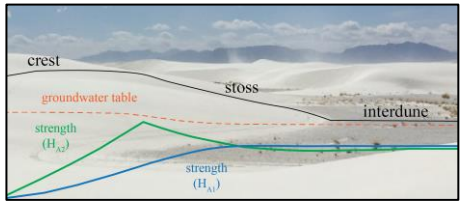
Results:



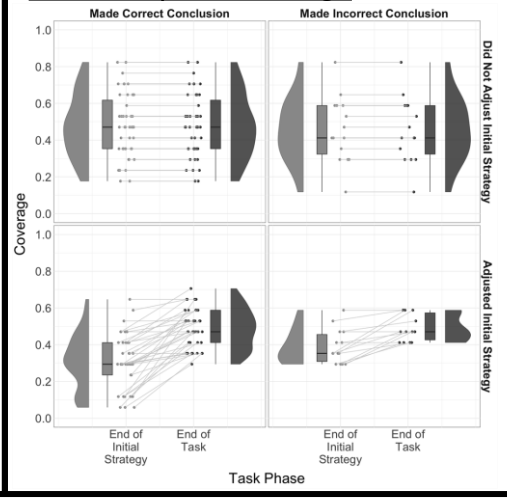


Science Exploration HRI

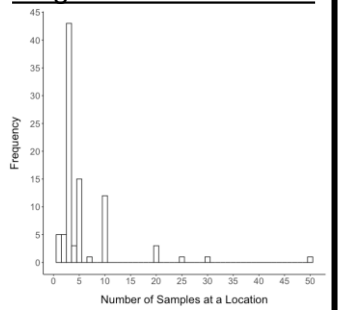
117 expert geoscientists evaluated hypotheses about sediment transport in simulation – collecting data along a dune using a "robot" that delivered real-time data, allowing for adjustment of sampling strategy in response to new info.



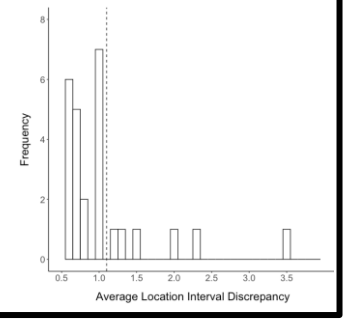
Variable space coverage:



Magic number heuristic:



Equal spacing heuristic:



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