Developing an Educational Robotic Platform

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Method

Laminate devices have the potential to lower the cost and complexity of robots. Utilizing the entrepreneurial mindset, these robots can be taken from research to the classroom, lowering both the technical knowledge and financial investment required for entry into robotics. Taking advantage of laminate materials' inherent flexibility, a high-performance jumping platform is developed with a focus on open and affordable design. In the final stages of developing this platform, three different simulators are compared as tools which students can use to learn about their designs. The results from these simulations are also compared against empirical results from a physical prototype.

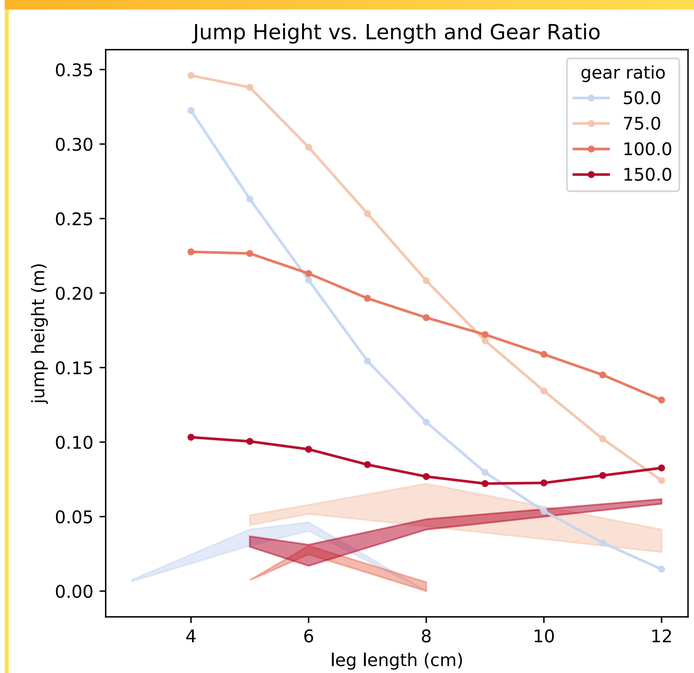
Comparison of Simulators

	Simulator		
Criteria	MATLAB	Unity	Pynamics
Applied Force	Yes	Yes	Yes
Inertia	No	Yes	Yes
Flexibility	No	Yes	Yes
Motor Model	Linear	Linear	Dynamic
Trends	Poorly	Well	Poorly
Jump Heights	Badly	Poorly	Well
Speed	Fast	Realtime	Slow

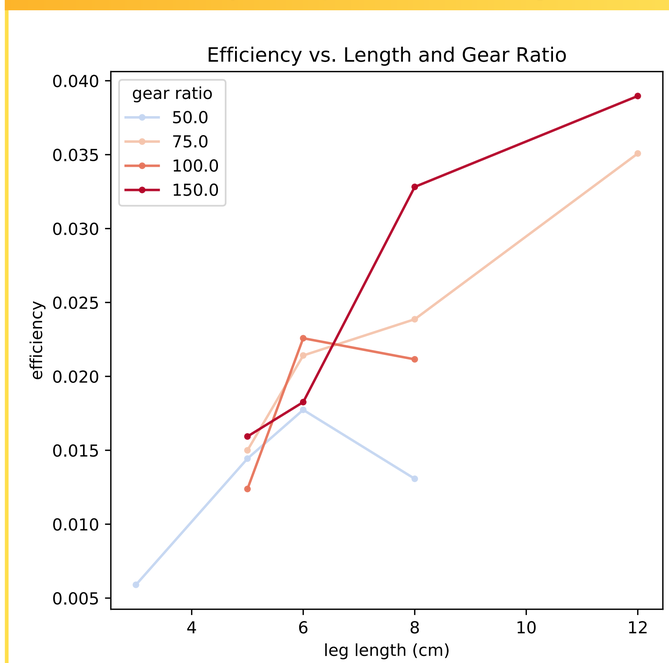
Conclusion

The MATLAB and Unity models both excel in speed, while the gains made in the accuracy of the jump height predictions of the Pynamics model come at a heavy cost, slowing down the simulation. Moreover, in spite of the Pynamics model's improved ability to predict jump height using a dynamic motor model, it is still far inferior to Unity in terms of predicting trends as design variables change. This leads to the conclusion that the Unity simulator better represents certain interactions within the system. Some potential areas to explore are contact forces between the leg and ground, the accuracy of the integrators, and damping coefficients.

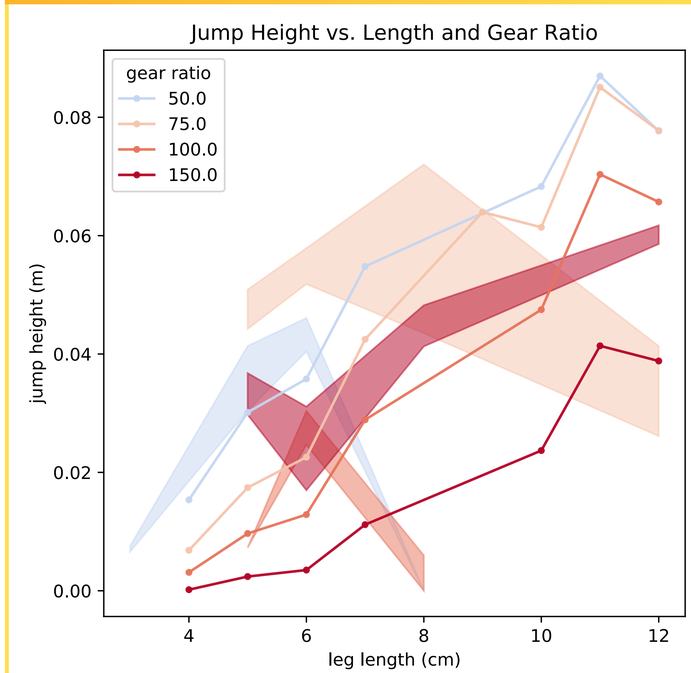
Unity vs Experimental



Efficiency of Experimental Designs



Pynamics vs Experimental



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