Developing and Educational Robotic Platform

Jacob Knaup, Engineering (Robotics)
Mentor: Dan Aukes, Assistant Professor
Polytechnic School

Method

Laminate devices have the potential to lower the cost and complexity of robots. Taking advantage of laminate materials' inherent flexibility, a high-performance jumping platform is developed. The platform is designed by simulating variable leg dimensions: first with a simplified single-mass, variable-force model and then through a full dynamic computer simulation incorporating variable lengths, masses, and flexibilities. The leg design variables are chosen from the simulation to optimize jump height. The platform's jumping ability is then tested and analyzed in comparison with the simulation results with the aim of improving the accuracy of the simulation predictions.

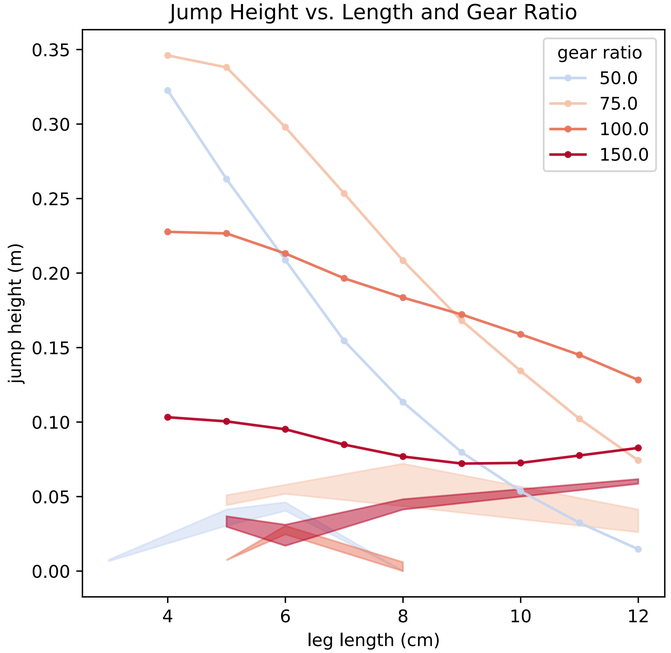
Comparison of Simulators

	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

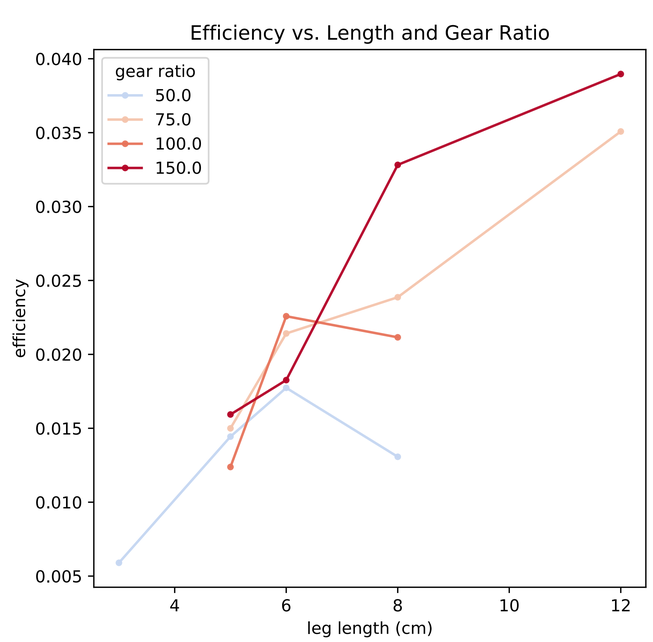
Conclusion

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.

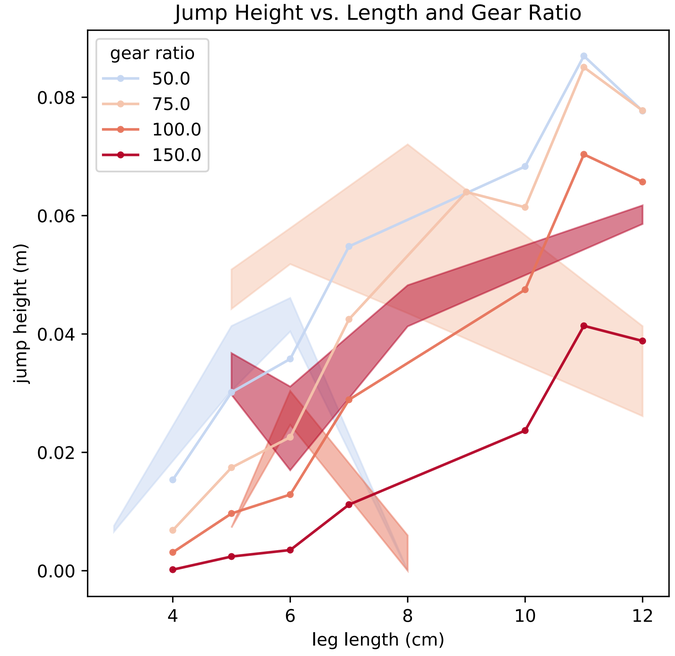
Unity vs Experimental



Efficiency of Experimental Designs



Pynamics vs Experimental



IDEAB

KEEN ENGINEERING UNLEASHED

ASU Ira A. Fulton Schools of Engineering
Arizona State University