

## Topic and Goals

The topic will be the design of low-cost robots. This will include design methodologies, modular devices, reusable models, and design tools. The focus will primarily be on robots utilizing 3D printing and laminate manufacturing, which are generally constructed from non-rigid materials and require unique considerations.

The goal of this work will be to show how those properties can be used advantageously, and to document these uses in a conference paper. For example, one expected outcome of this work is a process for a modular force-sensing device that can be easily incorporated into robot designs. This device will take advantage of the inherent flexibility of laminate materials and use it to register forces. Another expected outcome is a model for designing jumping and hopping robots. This model will incorporate the flexibility of the members in a leg and will be useful for optimizing the leg characteristics and for selecting an appropriate motor. Both will need to make reasonable estimates (of force and performance respectively), and this work will ultimately be presented in a conference paper.

## Method

I have already conducted work in these areas, so this thesis will be the culmination of previous work. To prepare the force sensing work for a conference paper, more detailed data will need to be collected to support the accuracy and usefulness of the force sensing device. A more robust mathematical model of the device will also be created to explain the function and force calculations that it uses. The jumping/hopping robot model will need some refinements to the model and the experiment itself. This will hopefully bring the theoretical and experimental results into closer agreement. Additionally, the limitations of the model that result in the discrepancies with the experimental results will be explained.

## Director Meetings

I will meet with my director on Thursdays for an hour. These meetings will be in small groups with other students who are working on related work. In these meetings, my director

will provide guidance regarding the direction of my research and suggest next steps for how my work should continue. He can correct potential problems with what I am doing and point out difficulties that may arise or obstacles that must be considered. I will also meet with my director on Fridays for an hour and a half as part of our weekly lab meetings. These meetings will mainly serve as an opportunity to present work with my lab mates and receive feedback and ideas on the accomplishments I have made and difficulties I am currently having.

## Second Committee Member Meetings

I will meet with my second committee member intermittently throughout the semester as his availability permits. We will hopefully meet as often as every other week to once a month. In these meetings I will update my second committee member on my progress, and he will offer his input in much the same way as my thesis director. This will likely take the form of pointing out problems I had not considered or suggesting better technics for conducting experiments or creating models.

## First Semester Timeline

Month	Month-End Accomplishments
September	Completed jumping/hopping model Final simulation results Considered experiment and refined setup as needed
October	Final jumping/hopping experimental results Experimental/simulation results are presentable Explanation for experimental/simulation results
November	Jumping/Hopping paper completed All figures drawn/generated Written explanation and discussion of results Literature review of related work Results presented according to clear story
December	Reviewed previous force-sensing work

## Second Semester Timeline

Month	Month-End Accomplishments
January	Improved, higher-performance jumping platform designed/constructed for demonstration/future use New version of force sensing device manufactured
February	Updated experimental results of force sensing device Complete model for force sensing device
March	Figures for force sensing paper generated
April	Force sensing/materials paper completed Literature review Potential applications discussion
May	Create pretty demo of thesis work to be kept in lab for future use