# 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

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| 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

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| --- | --- |
| 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 |