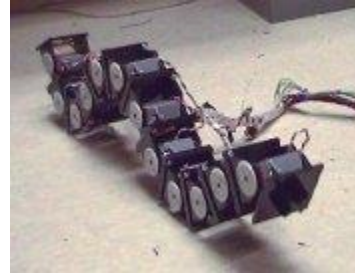**Mechanical & Mechatronics Engineering**
University of Waterloo

ME 547: Robot Manipulators: Kinematics, Dynamics, and Control

Lab 3/Project Instructions

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Lab 3: Experimental Project

Project Proposal Submission:

Students will take on a project of their own choice, and get approved by the instructor and/or TA. **Project proposals (2 page including descriptive title, describing your robotic system and main components, the main goal, the methodology you will follow, and a draft time line/schedule plan) are due at the end of the Week 5**. Please make sure to discuss with the TA/instructor for further clarification.

Project report instructions:

The write-up should be single space; 11 or 12 points font size; between 7-15 pages long single column, or between 4-8 pages long double column. Title page and table of contents not needed. Project report and demo/video submission **deadline is Week 13.**

The report should be in **ASME paper format** or **IEEE paper format**. (Please check asme.org and/or ieee.org for formats/templates.) It should contain the following parts:

- **Abstract**
- **Introduction** – briefly describe what you have done as the project
- **System Details and Problem Definition –** Describe the system you worked on in details and the goal of your project. Use diagrams and equations as well as verbal explanation.
- **Theory** – The goals of this section are to summarize how you did the project, so we can assess if you have understood the underlying principles. Briefly describe the platform you used, including the relevant sensors, actuators and/or controllers and their characteristics. Define the robot kinematics, dynamics, and summarize the system identification techniques used, if any.
- **Implementation** – The goal of this section is to provide details on your novel idea that you have implemented.
- **Results** – Present the simulation and/or experimental results in this section. The goal of this section is to convince a skeptical reader that you have correctly identified the system parameters, and your model of kinematics/dynamics accurately captures the robot you are working with. Present a discussion of the results, and make sure to explain why the method worked, or did not work.
- **Future Work**- Give some ideas as to how to extend and enhance the technique that you have presented.
- **Conclusion**
- **References**

Marking scheme:

Content: 60% total
Discussion of results: 20%
Presentation: 20%
- Nicely formatted, obeying the above rules
- Page limit observed
- Figures, tables labeled, no superfluous figures, no excessive display of raw data
- Appropriate references provided
- No table of contents needed

Sample project ideas:

Some of the ideas are presented here. This is not meant to be an exhaustive list. Please be creative and think of new project ideas, and get them approved by the instructor/TA.

- Chess playing robot manipulator
- Solving rubic cube with a robot arm
- PID controller for trajectory tracking of a 5-DOF robot arm
- Sample retrieval system from a bin
- Autopen-handwriting duplication
- Manipulator for flipping pancakes
- Gesture controlled robot arm
- Juggling robot
- Force control for grasping
- Etc.

You are welcome to use equipment of the ME 547 Lab, but not restricted to. You may inquire with other professors from MME, ECE, SyDE to work with them and/or use their relevant lab equipment. You may also check with undergraduate research clubs of UW Engineering. Here is a list of **some** of the professors who work on robotics: Drs. Jeon, Khajepoor, Melek, Waslander (MME); Drs. Basir, Karray, Kulic, Nielsen, Smith, Wang (ECE); Dr. McPhee (SyDE).