MECH 430 – Robotics

Term – SUMMER 2015 (201505)

Instructor
Dr. Jooeun Ahn
Phone: 250-721-8696
E-mail: jooeun@uvic.ca

Office Hours
Days: Tuesday and Wednesday
Time: 10:30 – 11:30
Location: EOW 533

Course Objectives
- Be able to develop mathematical model of various controlled robotic systems
- Be able to design the proper controller to operate the robotic manipulator in a desired manner

Learning Outcomes
- Develop mathematical model of a general robotic system
- Quantify the dynamics of the robotic system with reasonable accuracy
- Assess the performance of the uncontrolled and controlled robotic system
  - At minimum, evaluate stability
- Design proper controllers to obtain the desired behaviors of robotic devices
- Define the objective of robotic motion mathematically and design optimal controller to achieve that goal
- Relate input command to the output dynamics of a robotic manipulator

Syllabus

<table>
<thead>
<tr>
<th>Weeks</th>
<th>Tuesday</th>
<th>Wednesday</th>
<th>Friday</th>
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<tbody>
<tr>
<td>May 4 – 10</td>
<td>Introduction, review of Dynamics</td>
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<td>May 11 – 17</td>
<td>Stability of open loop dynamical systems</td>
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<td>May 18 – 24</td>
<td>No class (Victoria Day)</td>
<td>Review of feedback control</td>
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<tr>
<td>May 25 – 31</td>
<td>Stability of closed loop systems</td>
<td>No class (Conference)</td>
<td>Stability of closed loop systems</td>
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<td>June 1 – 7</td>
<td>Actuators Assignment 1 due</td>
<td>Actuators and drives</td>
<td>Quiz 1</td>
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<td>June 8 – 14</td>
<td>Vehicle kinematics and control</td>
<td>Planning</td>
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<td>June 15 – 21</td>
<td>Planning, optimization, and optimal control</td>
<td>Optimization</td>
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<td>June 22 – 28</td>
<td>Legged locomotion</td>
<td>Quiz 2</td>
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<td>June 29 – July 5</td>
<td>Return map analysis</td>
<td>No class (Canada Day)</td>
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<td>July 6 – 12</td>
<td>Robot arm manipulator</td>
<td>Robot arm manipulator</td>
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<td>July 13 – 20</td>
<td>Quiz 3</td>
<td>Jacobian and singularity</td>
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<td>July 21 – 28</td>
<td>Inertia and stiffness matrices</td>
<td>Impedance and interaction control</td>
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<td>July 28 – 31</td>
<td>Machine learning</td>
<td>Review and summary</td>
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**A-Section(s):** A01 / CRN 30553  
**Days:** Tuesday, Wednesday, and Friday  
**Time:** 9:30 – 10:20  
**Location:** ECS 104

**Required Text**
- **Title:** None  
- **Author:**  
- **Publisher:**  
- **Year:**  

**Optional Text**
- **Title:** None  
- **Author:**  
- **Publisher:**  
- **Year:**  

**References:** None

**Assessment:**
- Assignments: 40 % (4 assignments at 10% each)  
- Mid-term: 60 % (4 in-class quizzes at 15% each)  
- Due Dates: June 2, June 19, July 8, and July 29  
- Dates: June 5, June 24, July 14, and July 31

**Note:**  
Failure to complete and submit all assignments and quizzes will result in a grade of N. The final grade obtained from the above marking scheme for the purpose of GPA calculation will be based on the percentage-to-grade point conversion table as listed in the current Undergraduate Calendar.  
There will be no supplemental examination for this course.
Note to Students:
Students who have issues with the conduct of the course should discuss them with the instructor first. If these discussions do not resolve the issue, then students should feel free to contact the Chair of the Department by email or the Chair’s Secretary to set up an appointment.

Accommodation of Religious Observance
See entry in current Undergraduate Calendar

Policy on Inclusivity and Diversity
See entry in current Undergraduate Calendar

Standards of Professional Behaviour
You are advised to read the Faculty of Engineering document Standards for Professional Behaviour in current Undergraduate Calendar, which contains important information regarding conduct in courses, labs, and in the general use of facilities.

Cheating, plagiarism and other forms of academic fraud are taken very seriously by both the University and the Department. You should consult entry in current Undergraduate Calendar for the UVic policy on academic integrity.

Course Lecture Notes
Unless otherwise noted, all course materials supplied to students in this course have been prepared by the instructor and are intended for use in this course only. These materials are NOT to be re-circulated digitally, whether by email or by uploading or copying to websites, or to others not enrolled in this course. Violation of this policy may in some cases constitute a breach of academic integrity as defined in the UVic Calendar.