S y l l a b u s

(2013 / Fall)

Course No.	446.613	Sub. No.	A	Course Name	Nonlinear Systems Control	Units	3
Lecturer	Name : F. Chongwoo Park and Dongjun Lee				Homepage : http://mae.snu.ac.kr		
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1. Goals	Unlike past years, the focus of the course for this semester will be on system-theoretic methods in robotics; the basics of nonlinear systems theory will now be covered in the newly established graduate course, *Control Systems 2*. The first part of the course will cover motion planning methods and algorithms. After covering basics of robot modeling at the kinematic and dynamic levels, we shall examine potential field methods, task decomposition control. We then examine the two basic approaches to probabilistic planning, the roadmap algorithm and its variants, and the randomly exploring random tree and its variants. The instructor for the first half of the course will be F.C. Park. The second half of the course examines control problems in human-interactive robotics, with a focus on teleoperation control and haptics. The instructor for the second half of the course will be D.J. Lee. **All students must receive the consent of the instructors prior to registering for the course.**						
2. Textbook and references	The prerequisites for the course are an understanding of robot kinematics and dynamics at an advanced undergraduate level, and an introductory course in systems and control or linear systems theory. The course will be mainly based on paper reviews and presentation by students. The list of papers to review will be assigned before the class. Additional materials will be distributed as needed.						

3. Evaluation	attendance	participation	other	project II	project II	e.t.c	Total
		20%		40%	40%		100%

4. Schedule	week	Schedule
	1	Robot kinematic modeling
	2	Robot dynamic modeling
	3	Potential field methods and task decomposition control
	4	Roadmap algorithm
	5	Randomly exploring random trees (RRT)
	6	RRT variants
	7	Project I
	8	Teleoperation control: transparency, passivity, 4-CH architecture
	9	Teleoperation control: scattering and wave-variable approach
	10	Teleoperation control: other topics and techniques
	11	Control issues in haptics: Colgate's condition, virtual fixture, z-width
	12	Redundant manipulator control and operational space formulation
	13	Virtual constraint generation (if time permits)
	14	Review
	15	Project II

5. Notice	The course will have two projects, one related to motion planning, and the other related to human-interactive robotics.