EE683 Assignment 4

- ✓ **Due date:** Nov/27 (Friday) 23:59 (late policy: -10%point per day)
- ✓ **Submit to:** mjkim.lecture (at) gmail.com
- ✓ **File name:** HW4_[Student ID]_[Full name]_1.pdf (ex. HW4_20201234_홍길동.pdf)
- ✓ **Style:** use IEEE LaTeX style (conference, double column)
- ✓ **Page length:** at least 2 pages. Less than 2 pages will be regarded as "not submitted". There is no upper limit, but please try not to exceed 6 pages.
- ✓ **Language:** English
- ✓ **Format:** there is no fixed format as far as you include (i) summary of the lecture, and (ii) example
- ✓ **Summary of the lecture (50% of grading):**
  - Your own summary for the lecture 14,15,16,17,18.
  - The purpose is to prove that you studied and understood.
  - You have to explain things in your own language. Don't just copy and paste equations from the lecture slides, and argue that you understood. This is not accepted.
  - Instead, try to use plain English with figures. Key equations should be there of course, but please don't fill out space with a number of equations for no reason.
- ✓ **Example (50% of grading):**
  - Make your own example. Implement, simulate and discuss about the result.
  - You may solve a basic question (provided below), but you can get only 25% of grading.
  - Basic question: Consider a 2-DOF robot that you used for the assignment #2. Define your task variable as x-direction position ($\in \mathbb{R}^1$). Apply PD controller for this task variable without considering null-space dynamics. Discuss about the resulting robot behavior, and implement null-space controller as well for comparison.
  - For the assignment #4, you have two ways to get the rest 25%.
    - First way is to, as usual, make your own example which is more advanced than the basic one. The advanced problem can be designed in the scope

of Lecture 16, 17,18.

- Another way is to read and summarize the following paper in addition to the basic question: An overview of null space projections for redundant, torque-controlled robots, IJRR 2015 by Alexander Dietrich.