ME567/EECS567/ROB510 Final Exam, WN2024 (Prof. Bruder)

Time, Place, Rules and Review

- You will have a 24 hr period to complete and turn in the take-home exam. It will be released at 12pm on Tuesday, April 30 and is due at 12pm on Wednesday, May 1. *This is a STRICT deadline–late submission will not be allowed (automatic ZERO), so don't risk it.*

- Please submit QUALITY photos/scans to Canvas.

- NO COLLABORATION OF ANY KIND

- Open textbook, class notes, homework

- Calculator/MATLAB/Mathematica allowed but must show calculation steps for full credit. For example, if a question asks you to derive a Jacobian, it is not sufficient to just use a built-in Jacobian function to do it for you. Someone should be able to follow every step of your work *without* looking at your code. You can use software to automate things like arithmetic and matrix multiplication, but you should explicitly write out the matrices being multiplied.

- It is unethical to enter a question directly into a search engine, hoping to find the answer. Usually this won't help you anyways. You may search definitions/topics but not verbatim questions. NO CHATGPT!

- Piazza will only allow private questions to the instructional team during exam hours. We will make appropriate questions/answers public, so please check to see if your question has already been asked/answered before posting it.

- **Review:** We are available for Q&A and practice exam review during regular office hours. Please come prepared with questions and we will do our very best to answer them.

Material Covered

- All lectures

- All HW assignments

- The exam is cumulative but will emphasize post-midterm material

- Non-exhaustive list of topics: Rigid body transformations, local and global representations of SO(3), homogeneous transformations, twists, screws, exponential maps, adjoint transformation, forward kinematics, inverse kinematics, rigid body velocities, wrenches, manipulator Jacobian, singularities, manipulability, Lagrangian and Hamiltonian dynamics, robot equations of motion, properties of robot dynamics, Lyapunov stability analysis, multivariable robot control (PD, flexible joints, inverse dynamics, adaptive, passivity-based), force control (e.g., impedance), feedback linearization, underactuated control (if we get to it)

The exam will **not** cover:

- Quaternions

- Robust inverse dynamics control

Type of Questions

- The exam format will look similar to the ROB510 practice exams on Canvas.

- Roughly half the exam will be True/False questions that test concepts. The other half will involve problem solving, i.e., written answers showing work.

- If you give more than one solution to a problem, you must tell me which one to grade. If you do not tell me which one to grade, I will grade the first one, even if it is wrong and something later is correct. What else can I do? The only reason I mention this is because it has come up in the past.

- Students sometimes ask if they have shown enough on the workout problems. **I cannot answer that question.** My best advice is to show your work clearly. Show the steps you are following. You do NOT need to re-derive basic properties we have established in class or HW. You can just state it as a fact and then use it.