**Oregon State University**

**Actuator Dynamics**

**Task Analysis**

**Presentation Due: Wednesday, Week 8**

For a set of 3 tasks as described in assignment 3:

* + Pick a force control task (1 dimensional):
    - Holding a coffee cup in a moving car (unknown disturbance, minimize peak force)
    - Opening a swing door while walking forward (constant forward velocity, minimize peak force)
    - Reeling in a fish (generate a constant force given a varying external force)
    - Writing (constant force following a surface)
    - Propose your own force control task
  + And one position control task (1 dimensional):
    - Move between two precise locations quickly (pick-and-place)
    - Follow a precise trajectory with random externally applied forces
    - Propose your own position control task
  + And a real-world, complex, likely including hybrid dynamics, such as but not restricted to:
    - Spacecraft docking (catch an uncertain mass at uncertain speed, minimize peak force)
    - Hammering a nail (maximize peak force, periodic operation)
    - Hopping (bandwidth refers to the frequency)
    - Emulate specific dynamics that differ from the actuator’s
    - Spring-mass walking
    - clean-and-press lift

Implement simple controls (i.e. PD, PI…) on your actuator alone (without added passive dynamics), assuming complete knowledge of system state (i.e. perfect sensing), to achieve those three tasks.

**Deliverables**

* Benchmark each task: show example behavior at different frequencies, and show frequency plot for each task that illustrates bandwidth
* Show the task with animations

**Goal:** Show the limitations of your actuator.

* Control your base actuator to try to achieve the tasks (force control, position control, real-world task). Show how performance degrades, see where the obvious flaws and limitations are. Show bandwidth limits with some frequency plot. Gain intuition for how each of these actuators will work in an application. Create a benchmark comparison for your next assignment, where you will add passive dynamics to improve performance.