EECS 270 – Robot Algorithms
Lab N. 1 – Fall 2017

Important Information

1. This lab is due on September 14, 2017 by the deadline specified in CatCourses.
2. You solution must be submitted electronically through CatCourses.
3. Labs MUST be solved individually.
4. Your solution must be coded in Matlab and strictly follow the given requirements. Failure to comply with the desired structure for the input/output files leads to an immediate 0.

Inverted Pendulum Simulator

Study very carefully section 2.1 and 2.2, and 2.3 in Murray's book (see link in CatCourses) and consider the inverted pendulum example (Eq. 2.10). Write the following matlab functions:

- `[thetaN,thetadotN]=simulateOneStep(theta,thetaDot,deltaT,u)`: a function that takes as parameters $\theta(t)$, $\dot{\theta}(t)$, $u(t)$ and Δt and predicts $\theta(t+\Delta t)$, $\dot{\theta}(t+\Delta t)$. Assume all other constants are known (γ, m, l, etc.). These should be set in the beginning of your file. For the time being you can assume they are all equal to 1. Specific values will be given later on. Note that to solve this question you need to dicretize time, using for example Euler integration.

- `[thetaN,thetadotN] = addNoise(theta,thetadot,mu,sigma)`: a function that superimposes noise ν to θ and $\dot{\theta}$. This end, assume ν is a bivariate Gaussian with mean μ and covariance matrix Σ (input parameters to the function.)

- `[thetaN,thetadotN] = simulateSequence(theta,thetadot,u,deltaT,mu,sigma)`: a function that takes as input $\theta(t)$, $\dot{\theta)}(t)$ and vector `u` with `N` values for the input and simulates the evolution of the pendulum to get $\theta(t+N\Delta t)$ and $\dot{\theta}(t+N\Delta t)$. At each simulation step, superimpose noise to both state variables assuming a bivariate gaussian distribution with given μ and Σ.

This simulator will be used in the next assignment, when you will have to write an MDP based controller to stabilize it.