ME 599/AA546/EE546: Biology-Inspired Robot Control

University of Washington, Autumn 2016

Instructor: Prof. Sawyer B. Fuller

term project topics

This year, the possible topics are:

1. In problem set 1, we explored creating a simulation of "Braitenburg vehicles": simple robots whose wheel speed depends on light or other environmental stimuli. In this project, you will add additional sensor types, memory, or other functions. The idea is to build in one or two significant new features into the vehicle to make it exhibit more sophisticated behavior such as alternating between different food sources.

2. In McLeod1996, the algorithm by which baseball and cricket fielders catch a ball was explored. In this project, you will write a simulation of the ball's trajectory, subject to wind drag and disturbances. Then, use your simulation to confirm whether the simulated fielders are able to intercept the ball if they use the algorithm suggested in the paper. Does your simulation predict the behavior shown in Figure 3? If not, can you propose a plausible additional mechanism or dynamics model (that is, one that could realistically be implemented by a human) that can better reproduce the observed behavior?

3. (This problem may require more advanced feedback control preparation) Consider the dynamic flight controller for the robot fly covered in Lecture 2 (and downloadable from the course website). This simulation represents the situation in which the robot is flying in a motion capture arena in which feedback about its precise position and orientation is available. Two possible augmentations to this controller are:

   (a) Consider a more realistic scenario, such as what is faced by insects, in which motion capture feedback is not available. Can you make the robot fly in a controlled way using only feedback from sensors carried onboard? Examples include giving it additional sensors, such as a simulated downward facing "optic flow" sensor for altitude control (as in Franceschini07) or to enable it to hover in one place, or the addition of a gyroscope for angular velocity feedback. As an intermediate step, you could remove feedback in stages, removing attitude feedback but retaining position feedback, or vice versa, to make the problem easier to start with.

   (b) Can you make it execute more interesting behavior, such as performing a dynamic maneuver in the air, navigating a confined space, or maneuver or land in the presence of simulated wind?

In addition, you may pick a topic of your own choosing, subject to instructor approval. This can include implementation on a physical robot of your choosing, but the primary component cannot be hardware development. The need for instructor approval is there to help insure that the project is not too ambitious to be completed in a quarter's time.