Zachary Weiss

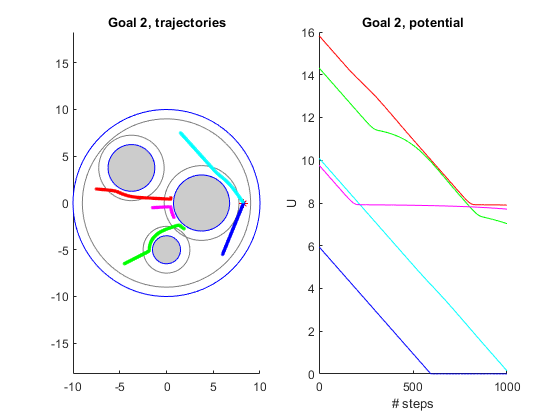
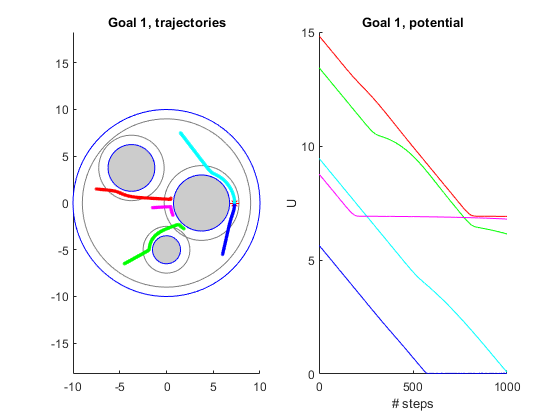
ME570 HW3

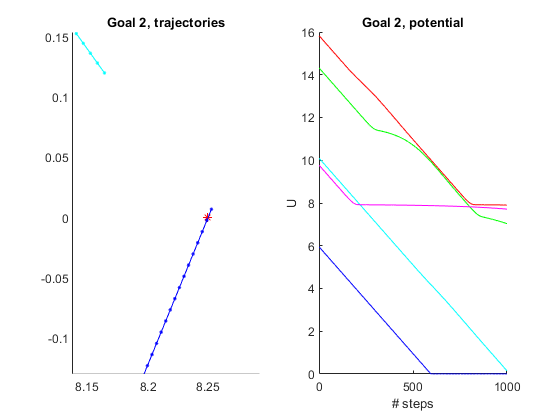
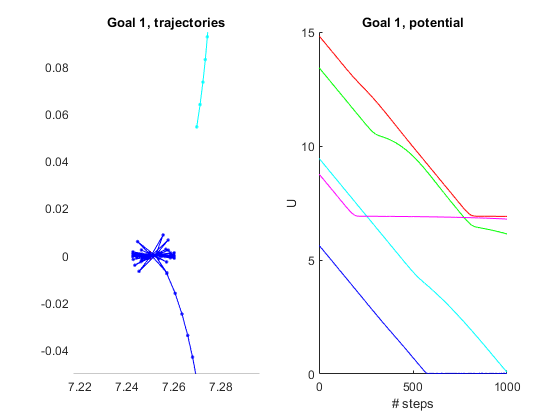
Professor Tron

29 October 2020

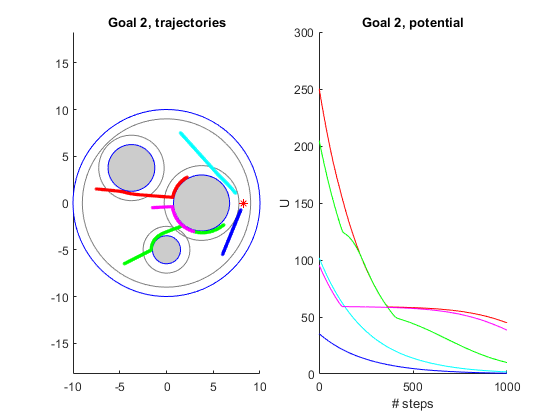
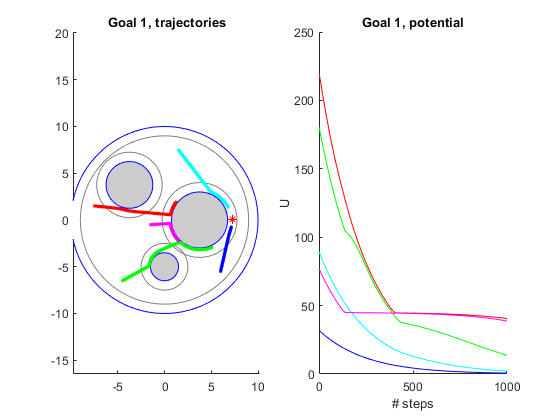
*Q2.1*:

With a conic shape, an epsilon of 1e-2, and a repulsive weight of 5e-2, we get the following results:





Similarly, for a quadratic shape, epsilon of 1e-3, and a repulsive weight of 5e-2, we get:



*Q2.2*:

*Q2.3*:

*Q2.4*:

*Q2.5*:

*Q3.1*:

The QP will have the form:

Subject to:

*Q3.2*:

*Q3.3*:

*Q3.4*:

A key tradeoff observed in just producing the above images is the computational intensity of a CLF-CBF approach. Luckily, there are “tricks” one can use to minimize that tradeoff, such as passing a smaller grid, as well as the fact that the CLF-CBF method enables higher epsilons than gradient methods.

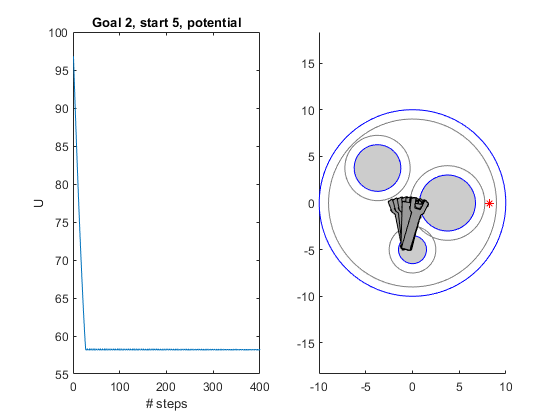
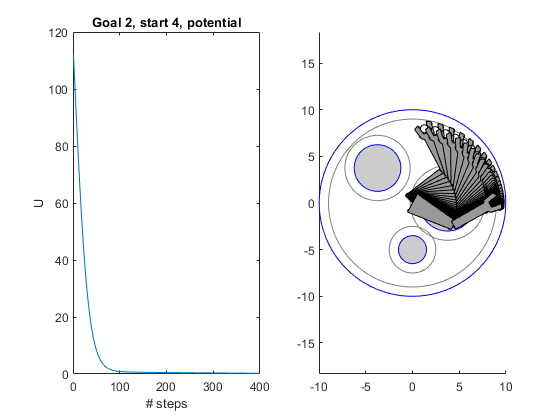
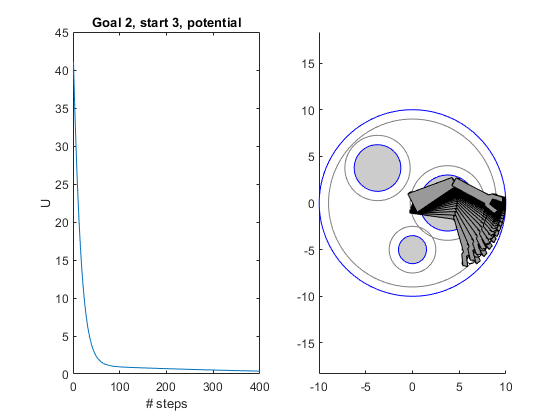
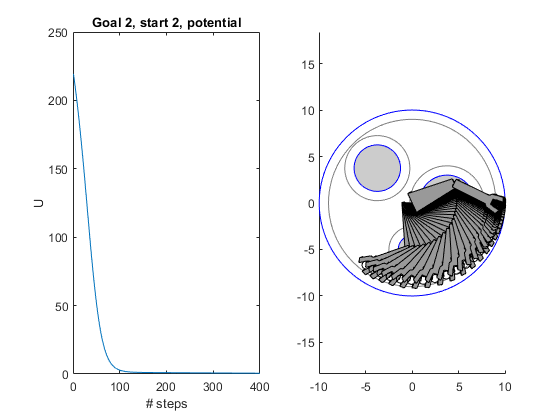
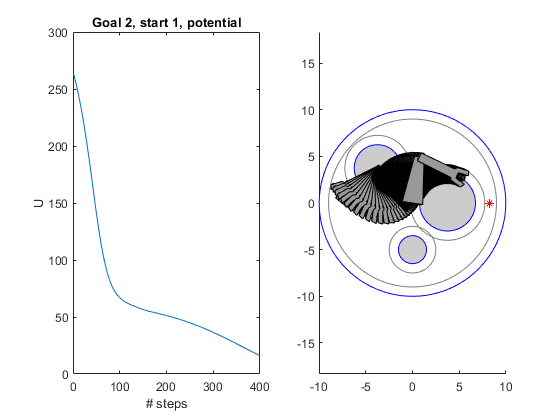
*Q4.1*:

We know from HW2, Q6.1 that

As such, to find J such that , we simply must factor out the vector, yielding the 2-by-2 matrix:

*Q4.2*:

There did not seem to be a combination of epsilon and repulsiveWeight settings that made start position #5 feasible (within approx. NSteps = 400, given infinite time it would ‘unstick’, minor rotation CCW seen in the period allotted), but epsilons in the range of 2e-4 to 1e-3 and repulsiveWeights in the range of 5e-3 to 1e-1 worked for the other start positions well. At an epsilon of 2e-4, and a repulsive weight of 1e-2, the following results were obtained:



*Q5.1*:

It’s harder to estimate the total time spent on this homework as I spread it across many sessions of work, but all total it was somewhere around a (waking / working) days’ worth of time.