ME 455 – Active Learning

Homework 5, due date: June 5, 2023.

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Problem 1

Figure 1 shows the maximally ergodic trajectory computed for the system and metric described in the homework. The following other parameters have been assumed:

- $K = 10$. K stands for the maximum possible value entries of k_i may have. For example, for a choice of $K = 2$, the possible k_i's are the following:

$$k = \{[0,0],[0,1],[0,2],[1,0],[1,2],[2,0],[2,1],[2,2]\},$$

- range X with bounds $lb = -5$, $ub = 5$,
- $DJ(\xi) \cdot \zeta$ convergence threshold $\epsilon = 10^{-2}$,
- $\gamma = 0.1$,
- $q = 10$, $Q = \mathbb{1}$, $R = 0.01 \cdot \mathbb{1}$,
- initial trajectory: $u_0(t) = [-0.5 \cdot cos(\frac{\pi t}{5}), -0.62 \cdot sin(\frac{\pi t}{5})]$, corresponding to an ellipsis around (0,0) with its major axis along x_2.

Figure 2 shows the evolution of $J(\xi_i)$ and $DJ(\xi_i) \cdot \zeta_i$, both of which are decreasing constantly.

While the ergodic metric of the optimal trajectory found is better than of the initial trajectory, it does not coincide with the expected trajectory for the unimodal distribution $\mathcal{N}(\vec{0}, 2 \cdot \mathbb{1})$, where the trajectory passes through the center of the distribution (shown in the following paper for a unimodal distribution with different μ, Σ: `https://arxiv.org/pdf/1808.06652.pdf`). The algorithm possibly has to run for a longer time, as the trajectory does seem to converge towards passing through (0,0) with an increasing amount of iterations. For the 175 iterations it took to reach $DJ(\xi_i) \cdot \zeta_i < 10^{-2}$, however, the algorithm already ran ˜30 *min*.

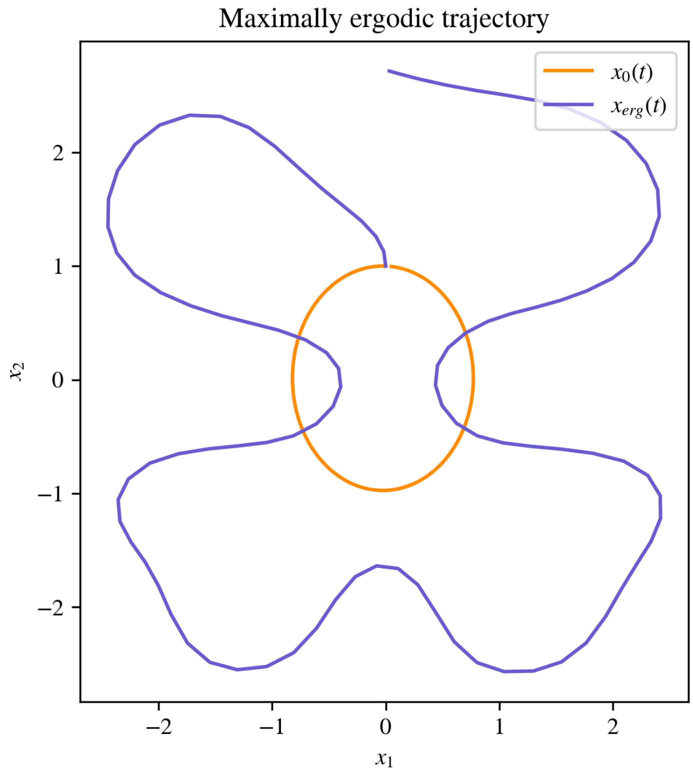

Figure 1

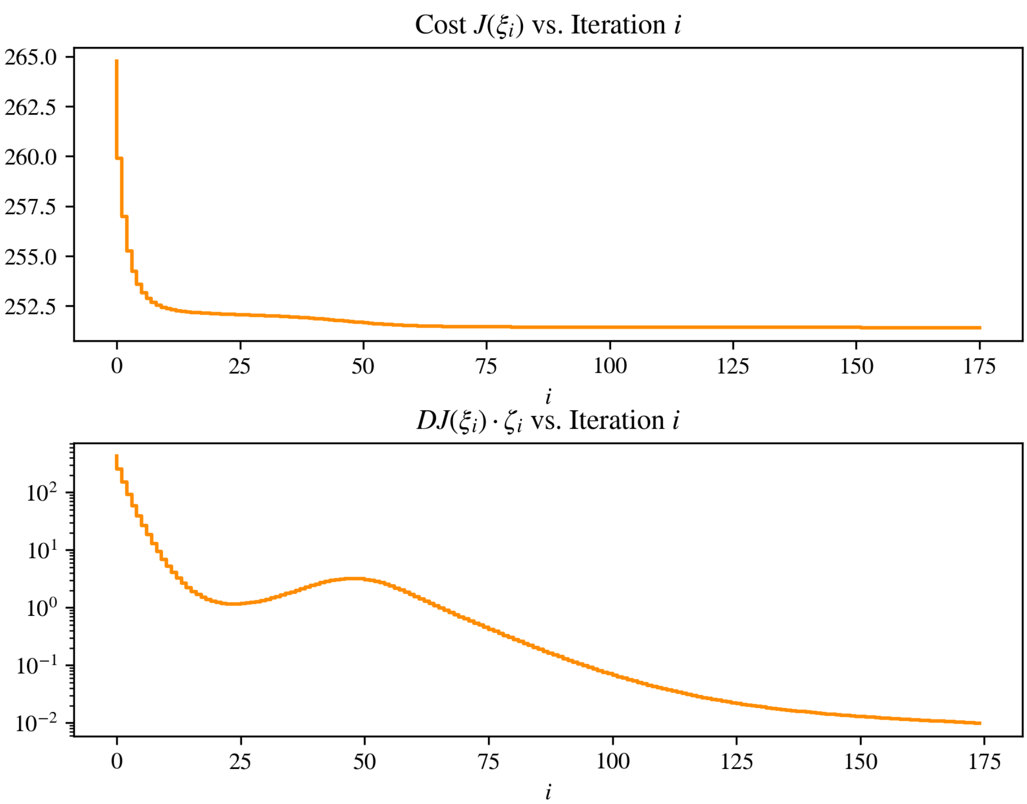

Figure 2