

## Near Time-Optimality

In this section, we demonstrate the near time-optimality of the trajectories generated by CoDiG by comparing them with trajectories obtained by solving an offline time-optimal control problem. As illustrated in Fig. 1, we present several representative obstacle configurations extracted from a real-world experiment. In each scenario, the red trajectory denotes the real-time obstacle-avoidance path generated by the CoDiG framework, while the black trajectory represents the time-optimal path computed offline under the same obstacle layout.

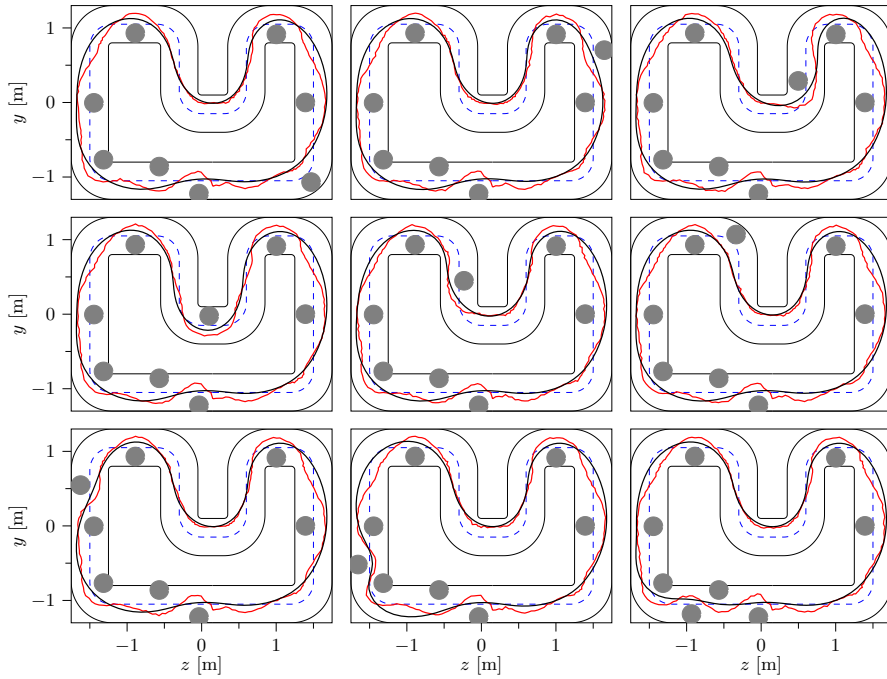


Figure 1: Comparison between trajectories generated in real time by CoDiG (red) and offline-computed time-optimal trajectories (black) under various obstacle configurations.

Overall, we observe a high degree of similarity between the real-time and offline trajectories, which highlights the near time-optimal generation of CoDiG in practice. The main discrepancies are observed in two typical situations. First, to achieve faster cornering, the offline time-optimal solution tends to favor a larger turning radius in curved sections. Second, when navigating near obstacles, the CoDiG-generated trajectory increases its clearance for safety, resulting in a slight deviation from the time-optimal path. This trade-off ensures safety while maintaining strong time-efficiency.