Online Reinforcement Learning Control of Nonlinear Dynamic Systems
〜An Online Q-Learning Based Solution to Optimal Control Problems〜

概要

We have developed an online reinforcement learning-based solution to the optimal control problem of continuous-time nonlinear deterministic systems. The approach does not explicitly require the input dynamics and relaxes the confining persistence of excitation condition.

特徴

- A concurrent identifier is designed to simulate the Bellman error in some unvisited points.
- The simulated errors together with the error obtained along the trajectory of the system are used to estimate the Q-function, from which the controller is derived.
- The approach does not explicitly require the input dynamics, which is hard to segregate it from the drift dynamics in optimal regulation problems.
- Simulated Bellman errors relax the persistence of excitation condition.

今後の展開

- We will consider to design a safe RL-based solution to the optimal control problem of safety-critical systems where task restarts are unavailable.

テーマ「Society5.0への貢献〜サイバーとフィジカルの融合に向けて〜」との関連

- The proposed method is online which provides fast solution to the reinforcement learning-based control, and has less computational load. These features are essential in the control of cyber-physical systems.