# Safe reinforcement learning for optimal control of constrained nonlinear systems

김연수†, 조현우
광운대학교
(kimy3@kw.ac.kr†)

Reinforcement learning (RL) is getting big attention in real application fields such as robotics and autonomous driving. To apply RL to chemical processes, safety and stability should be guaranteed during the learning and at the end of training. In this study, we propose a model-based RL for nonlinear systems with state and input constraints. The constraints are augmented into the objective function using the Lyapunov barrier function, and the optimal value function is trained by the stability-guaranteed RL proposed in the author's previous work. The sum of the Lyapunov neural network and barrier function is used as the approximate function, and Sontag's formula with this approximate function always guarantees the satisfaction of constraints and stability. The safety and optimal performance of the trained controller are validated using four tank simulation results. This work is supported by the Korea Agency for Infrastructure Technology Advancement(KAIA) grant funded by the Ministry of Land, Infrastructure and Transport (No. 21ATOG-C162087-01), and by the National Research Foundation of Korea(NRF) grant funded by the Korea government(MSIT) (NRF-2021R1C1C1004217).