学 位 論 文 概 要

題　目　　A Study on Designing Schemes of Data-driven PID Controllers Based on Augmented Output
（拡張出力に基づくデータ駆動型 PID 制御系の設計に関する研究）

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This dissertation has presented the data-driven PID controller design schemes. All of them are based on the minimization of the augmented error and the augmented error is derived from an I-PD control law. Thus, it is easy to understand the mechanism of the methods and employ for industrial systems such as distributed control systems.

In chapter 2, a PID controller tuning method for a time-invariant single-input/single-output system is proposed. The proposed method determines a set of PID gains without system modeling for one set of closed-loop input/output data. The effectiveness of the proposed method has been evaluated through numerical examples and an experimental result using the pilot scale temperature control system.

Chapter 3 has presented a design method of a data-driven self-tuning PID controller. The controller is based on a tuning method explained in chapter 2. The optimization problem of Chapter 2 has been rewritten, and a recursive least squares algorithm has been introduced. Furthermore, an asymptotic convergence property and stability of the proposed controller has been proved. The usefulness of the proposed method has been illustrated by some numerical snd experimental examples.

Chapter 4 has expanded the self-tuning scheme to a multi-input/multi-output (MIMO) system. The scheme has been expanded to a multi-loop control system. The behavior of the proposed scheme has been simulated numerically. In addition, the potency of the proposed method is verified through the tank system.

In the future, higher productivity should be required in industrial fields. However, the control performance using a PID controller is limited. For example, a system with long time-delay cannot be controlled easily, and controlling a system with nonlinearity is still one of the biggest problems. To tackle these problems some sophisticated controllers such as neural network controller and model predictive controllers can be used. However, the complicated controllers cannot be tuned instantly by operators. To tackle this problem, the design and industrial development of functional PID controllers are one of the future researches.