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دانشکده مهندسی برق و کامپیوتر

بررسی راه‌های افزایش بهره‌وری در سیستم‌های با بهره‌وری پایین

پایان‌نامه کارشناسی ارشد مهندسی برق – کنترل

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مراجع

Increasing Efficiency in Low-Efficiency Systems

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Abstract

In most applications, because of numerous advantages it offers, digital technology (computer, PLC, microcontroller etc.) is used to control industrial plants. These types of systems, where the process under control is continuous-time but the controller is digitally implemented, are called sampled-data systems. Faults can occur in sampled-data systems like any other control system. In order to prevent performance degradation, physical damage or failure, faults should be promptly detected. In this thesis fault diagnosis in sampled-data systems is studied. The sampled-data design can be carried out using direct or indirect design approaches. Direct design, emphasized in this research, does not involve any approximations.

Normally, to design a robust fault detection and isolation (FDI) scheme, a performance index which is a measure of the sensitivity of the FDI to faults and its robustness to unknown inputs and disturbances is defined and optimized. Different performance indices based on norms are considered. Using the direct design approach and the so-called norm invariant transformation, it is shown that a sampled-data FDI problem can be converted to an equivalent discrete-time problem. This will form the foundation of a unifying framework for optimal sampled-data residual generator design.

Multirate systems are also abundant in industry. Here, several methods of residual generation based on multirate sampled data are developed. The key feature of such residual generators is that they operate at a fast rate for prompt fault detection. The lifting technique is used to convert the multirate problem into an equivalent single-rate discrete-time problem with causality constraints.

It is generally believed that the optimal multirate design performs better than the optimal slow-rate and worse than the optimal fast-rate designs. This conjecture is theoretically proved in this thesis for general multirate control systems with norms of the closed-loop system as performance indices. However, it is shown that the common performance indices in FDI design do not satisfy this property. To resolve this, an alternative performance index is defined after formulating the FDI problem as a standard control problem.

Key Words: Fault Detection, Wind Turbine Control, Fault Accomodation, Unknown Input Observers

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