Design of QFT-based self-tuning deadbeat controller

Abstract

This paper presents a design method of self-tuning Quantitative Feedback Theory (QFT) by using improved deadbeat control algorithm. QFT is a technique to achieve robust control with pre-defined specifications whereas deadbeat is an algorithm that could bring the output to steady state with minimum step size. Nevertheless, usually there are large peaks in the deadbeat response.By integrating QFT specifications into deadbeat algorithm, the large peaks could be tolerated. On the other hand, emerging QFT with adaptive element will produce a robust controller with wider coverage of uncertainty. By combining QFT-based deadbeat algorithm and adaptive element, superior controller that is called self tuning QFT-based deadbeat controller could be achieved. The output response that is fast, robust and adaptive is expected. Using a grain dryer plant model as a pilot case-study, the performance of the proposed method has been evaluated and analyzed. Grain drying process is very complex with highly nonlinear behaviour, long delay, affected by environmental changes and affected by disturbances. Performance comparisons have been performed between the proposed self-tuning QFT-based deadbeat, standard QFT and standard dead-beat controllers. The efficiency of the self-tuning QFT based dead-beat controller has been proven from the tests results in terms of controller's parameters are updated online, less percentage of overshoot and settling time especially when there are variations in the plant.

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