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Comparison of Common PID Tuning Methods for Higher Order Plants

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ABSTRACT

Controlling the process is the main issue that rises in the process industry. It is very important to keep the process working probably and safely in the industry, for environmental issues and for the quality of the product being processed. PID control is a control strategy that has been successfully used over many years. Simplicity, robustness, a wide range of applicability and near-optimal performance are some of the reasons that have made PID control so popular in the academic and industry sectors. Recently, it has been noticed that PID controllers are often poorly tuned and some efforts have been made to systematically resolve this matter. In the paper a brief summary of PID theory is given, and then some of the most used PID tuning methods are discussed using five different higher order plants.

Keywords: PID Controller; Tuning Methods; Performance indices.

I: INTRODUCTION

Controlling the process is the main issue that rises in the process industry. It is very important to keep the process working probably and safely in the industry, for environmental issues and for the quality of the product being processed. The control problems leak out into the most areas of human operations. It includes machine control and business control operations as well. In the areas of technical relevance the concept of PID controller (Proportional-Integral-Derivative) is widely known. The tuning process of PID controller can be solved by experimental way (the expert is needed) or determined as optimization task. An optimal PID control design includes more goals of optimal regulation process which are often contradictory. Optimal setting of PID controller is generally a task of nonlinear mathematical optimization which is furthermore done on top of dynamic system.

The Proportional- Integral- Derivative (PID) controller is widely used in the process industries. The main reason is their simple structure, which can be easily understood and implemented in practice. Finding design methods that lead to the optimal operation of PID controllers is therefore of significant interest. A PID controller produces an output signal consisting of three terms – one proportional to error signal, another one proportional to integral of error signal and third one proportional to derivative of error signal. The combination of proportional control action, integral control action and derivative control action is called PID control action. The combined action has the advantage of each of the three individual control actions. The proportional controller stabilizes the gain but produces a steady-state error. The integral controller reduces or eliminates the steady-state error. The derivative controller reduces the rate of change error. The main advantages