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INTEGRAL VARIABLE STRUCTURE CONTROLLER

I.A. Tutov

Tomsk Polytechnic University, Russia, Tomsk

Abstract – In this research, we consider the integral variable structure controller. Research includes comparison analysis of control qualities with PID-controller and system robustness analysis.

Now we consider two controller synthesis approaches. Most of industrial processes are controlled by using proportional-integral-derivative (PID) controllers. The popularity of PID controllers can be attributed partly to their good performance in a wide range of operating conditions and partly to their functional simplicity, which allows engineers to operate them in a simple, straightforward manner. To implement such a controller, three parameters must be determined for the given process: proportional gain, integral gain, and derivative gain [1]. Restrictions cannot be taken into account when we choose gain values in the controller. This problem is solved by specialized packages. In the example (fig. 3), the PID-controller was tuned in Check Step Response Characteristics. It is utility of Simulink Library of MATLAB.

Second solution is developed variable structure controller, which based on State Space analysis [2]. In order to get one more state variables we introduce integrator. This controller enables us to consider restrictions on the synthesis stage of control strategy. This is time-optimal system. It is easy to implement this control strategy with computer equipment. Such a control strategy allows us to reduce erasing actuators. But this control strategy is sensitive to variations of system parameters and can lead system to instability.

To achieve effective control strategy in industrial processes are used adaptive systems. These systems are usually based on the adjustment of gain in PID controller. It takes a long time for the selection of gain values by computer. Adaptation of the integral variable structure controller needs less computer calculation time than adaptation of the PID controller.

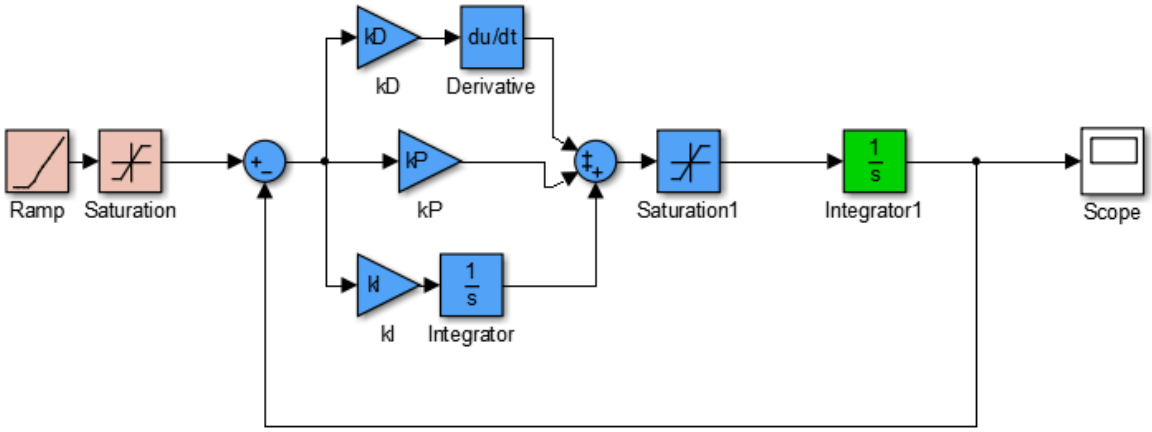

Fig. 1. System with PID controller

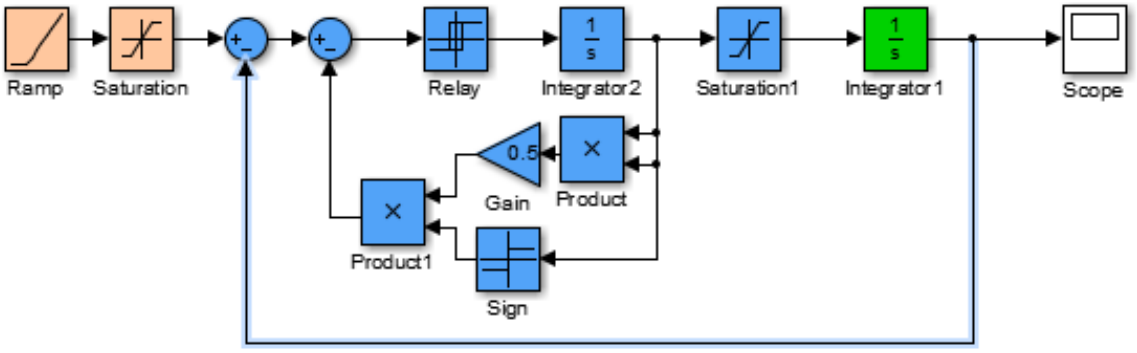

Fig. 2. System with integral variable structure controller

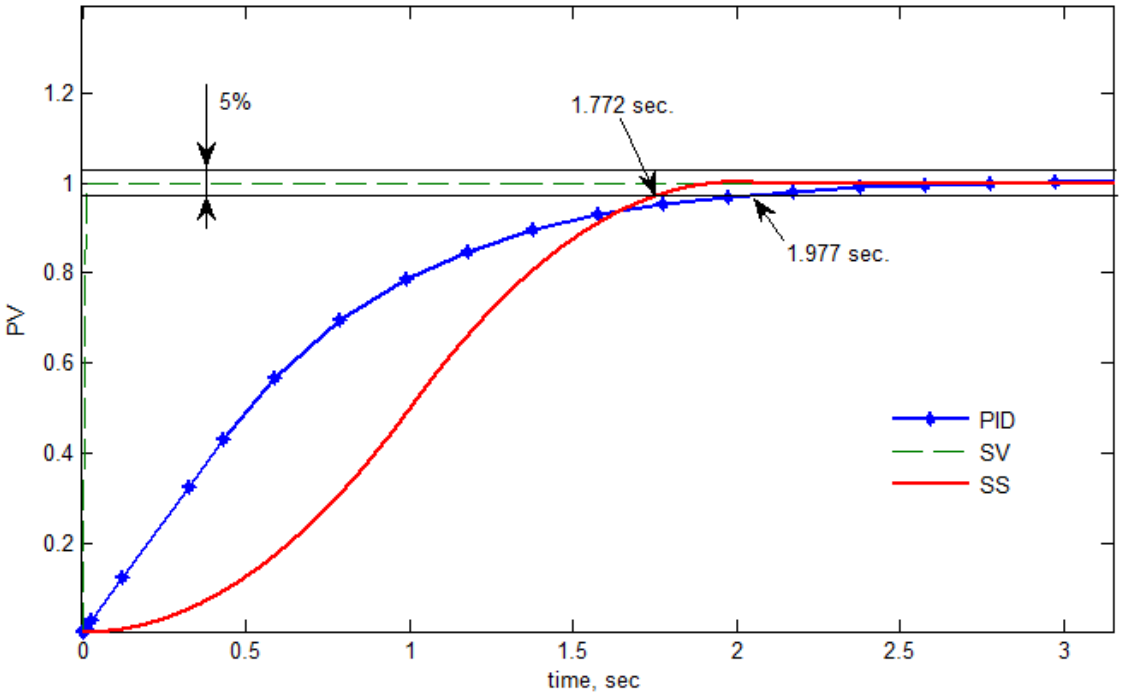

Fig. 3. Step response: PID – system on fig. 1; SS – system on fig. 2

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ADAPTIVE CONTROL SYSTEM OF DISTRIBUTED PARAMETER SYSTEMS

B.I. Pyakillya

Tomsk Polytechnic University, Russia, Tomsk

Аннотация – В теории автоматического управления существует задача управления объектами с распределенными параметрами. Ее важность обусловлена наличием множества реальных объектов, имеющих распределение параметров в своей структуре. Задача осложняется тем, что большинство алгоритмов синтеза регуляторов создано для объектов с сосредоточенными параметрами и учитывает свойства объектов, которые описываются дифференциальными уравнениями в частных производных и иррациональными передаточными функциями. Данную проблему можно решить, используя специальные алгоритмы идентификации, которые будут формировать, необходимые для управления, модели объектов. В данной работе представлен такой вид адаптивных систем управления, который объединяет подходы идентификации систем и метод адаптивного управления на основе модели (MRAC).

In current times there is a problem with concerning distributed parameter systems in control engineering issues. Importance of the problem is caused by controller design goals for industrial plants which have distribution in its parameters. For example, these parameters may vary from temperature of a rod or deflection of a laser's beam [1]. These systems are described by partial-differential equations (PDE) and often have high order partial derivatives. The transfer functions of distributed parameter systems (DPS) are irrational functions in contrast to lumped-parameter systems which are described by rational transfer functions. It brings complexity to controller design issues, because the most part of controller design algorithms relates to rational transfer function descriptions. Irrational transfer functions have