A NOVEL SYSTEM FOR DESIGN IMPLEMENTATION OF INDUSTRIAL ROBUST H-CONTROLLER FOR PROCESS CONTROL

The invention consists in a novel system for design, implementation and tuning of robust H-controller for SISO (simple input/simple output) and MIMO (multiple input/multiple output) for process control industrial applications; for which, only the typical knowledge of a plant operator is needed.

Background

Currently, in process industry the most usual approach implemented for process control is based on PID controller; and more than 90% of controllers in continuous processes installed in industries are PID. In general, and specially for typical SISO processes, this kind of controllers give satisfactory results, and plant operators have systematic procedures for tuning PID parameters. Disadvantages in PID controllers appear for SISO processes with complex dynamics and MIMO systems with significant interaction between different control loops; because, in this case, the process control becomes rather difficult due to interactions between different input and output variables.

Technology

Recently, other strategies, mainly those based on predictive control theory, have been developed and implemented for process control with commercial controllers. Nevertheless, there is not industrial controllers based on robust H control methodology which can be used and tuned by a plant operator. This is what is made in our system.

Robust H-control theory presents, from the theoretical point of view, excellent characteristics for controlling complex and MIMO processes; and some commercial software (named toolboxes) have been used for the design of such controllers. Nevertheless, the user of this software needs to know the fundamentals of theory so that such software is not appropriate to be used for a plant operator in industrial environment; instead of that, very qualified technicians or control engineers are needed for controller design.

Figure 1.- Interface of the control system designed by researchers of the University of Cadiz (Spain)
The research group of *Automatic Control, Signal Processing and System Engineering*, has developed a system with a practical methodology and systematic for robust H-controller design and implementation, which uses advantages of robust H-control theory, prevents main disadvantages which are presented for the control technician, and goes beyond due to it can be used by a plant operator. Our system involves a bridge between theory and practice, and validates the use and the H-controller tuning by a plant operator. Moreover, a H-controller auto-tuning procedure (pre-tuned controller) is implemented, for SISO and MIMO systems. Plant operator can get the controller fine tuning using three parameters for every controlled variable and a few rules of thumb.

**Advantages**

- The use of the system does not require either high qualification or special knowledge, so that it can be used by a conventional plant operator.
- An automatic procedure (auto-tuning) for obtaining a pre-tuned H-controller is implemented.
- A plant operator can easily use the system by means of a friendly interface.
- There is a direct relation between each H-controller tuning parameter and the expected effect in the control system.
- To carry out the H-controller fine tuning, few adjustment parameters are used, a systematic procedure is followed and plant operator can use rules of thumb for adjusting the closed loop behavior.
- The proposed system is valid for SISO and MIMO processes, with wide field of applicability in process control.
- It involves a bridge between theory and practice, so that it has the main advantages of robust H-control but only requires a typical plant operator to handle it.