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Implementation of a Paraconsistent-Fuzzy Digital PID Controller in a Level Control Process

Authors : H. M. Côrtes, J. I. Da Silva Filho, M. F. Blos, B. S. Zanon

Abstract : In a modern society the factor corresponding to the increase in the level of quality in industrial production demand new techniques of control and machinery automation. In this context, this work presents the implementation of a Paraconsistent-Fuzzy Digital PID controller. The controller is based on the treatment of inconsistencies both in the Paraconsistent Logic and in the Fuzzy Logic. Paraconsistent analysis is performed on the signals applied to the system inputs using concepts from the Paraconsistent Annotated Logic with annotation of two values (PAL2v). The signals resulting from the paraconsistent analysis are two values defined as Dc - Degree of Certainty and Dct - Degree of Contradiction, which receive a treatment according to the Fuzzy Logic theory, and the resulting output of the logic actions is a single value called the crisp value, which is used to control dynamic system. Through an example, it was demonstrated the application of the proposed model. Initially, the Paraconsistent-Fuzzy Digital PID controller was built and tested in an isolated MATLAB environment and then compared to the equivalent Digital PID function of this software for standard step excitation. After this step, a level control plant was modeled to execute the controller function on a physical model, making the tests closer to the actual. For this, the control parameters (proportional, integral and derivative) were determined for the configuration of the conventional Digital PID controller and of the Paraconsistent-Fuzzy Digital PID, and the control meshes in MATLAB were assembled with the respective transfer function of the plant. Finally, the results of the comparison of the level control process between the Paraconsistent-Fuzzy Digital PID controller and the conventional Digital PID controller were presented.

Keywords : fuzzy logic, paraconsistent annotated logic, level control, digital PID
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