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Synthesis of PID Controller for the Automatic Control System with Imposed Performance based on the Multi-Objective Genetic Algorithm

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Abstract:
This paper presents an improved algorithm for tuning of the proportional-integral-derivative controller, according to the maximum stability degree criterion with implementation the optimization procedure, based on the multi-objective genetic algorithm. According to the maximum stability degree criterion, the tuning parameters of the typical controllers can be calculated by the given analytical expressions that depends on the value of maximum stability degree. Based on these analytical expressions, it is presented the implementation of the multi-objective genetic algorithm, that permits to calculate the tuning parameters, which offers to the control system the settled range of performance. The fitness function is settled based on the imposed performance to the control system as overshoot, settling time, rise time. The proposed algorithm was verified by the computer simulation and there are presented some case studies. The case study was done for the situation when the control object is approximated with model of object with second order inertia with/without time delay, and model of object with third order inertia.