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Development of relay identification methods for complex system models using advanced parametric optimization techniques

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Abstract:

The use of relays or other nonlinearities in feedback for the purpose of estimating the parameters of a dynamic system model and possibly further designing a control algorithm has been theoretically developed and successfully used in practice for over four decades. The advantage of this framework approach is, among others, that the entire process remains in the vicinity of the operating point and can be performed continuously. Nevertheless, many research questions remain unanswered or only partially satisfactorily resolved. These include, for example, the procedure for determining a large number of unknown parameters in real time, reducing the number of necessary feedback tests, increasing the accuracy of the estimate under the influence of system disturbances and perturbations, or applying known techniques to more complex processes and their models (e.g., infinite-dimensional, highly nonlinear, multidimensional, etc.). The defined identification tasks then essentially lead to problems of parametric optimization (with constraints or multicriteria). Advanced optimization methods (e.g., metaheuristics) can be used to solve these problems. The dissertation aims to develop these methods, with an emphasis on modern optimization techniques and the experimental verification of the proposed theoretical concepts.

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