Abstract

The presented doctoral dissertation was divided into two sections – theoretical and applicational. The theoretical part aimed to generalise classical identification methods of nonlinear dynamic systems to enable application in selected real-life problems. The first presented algorithm is the multi-level identification of Hammerstein-Wiener systems. This complex approach to block-oriented methods supports the lack of knowledge related to the mathematical description of the system, due to the cascade connection of two nonlinear blocks and one dynamic block. The second proposed solution is focused on using the active experiment approach to identification. Many of the practical problems faced a challenge in modelling the system, because of large dimension spaces which led to slow asymptotical convergence. The proposed solution is based on dimensionality reduction using quantized or periodical excitations. The last presented solution uses the idea of decomposition and coordination, splitting the identification of the complex system into smaller and less complex tasks, with the use of the interaction prediction method. Alternate identification of Hammerstein system blocks was the subject of many publications, recent contribution lies in the nonparametric approach to nonlinear characteristics identification, and generalisation of the method to the ARMAX systems. The recursive versions of presented algorithms were developed as well.

The applicational part is focusing on the application of such a new approach in two real-life problems: an examination of the thermal ageing process of chalcogenide glasses in a differential scanning calorimeter and monitoring the technological process in CNC machines to detect any discrepancy, based on the current load measurement.

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