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PII: S0098-1354(17)30350-2
DOI: https://doi.org/doi:10.1016/j.compchemeng.2017.10.005
Reference: CACE 5911

To appear in: *Computers and Chemical Engineering*

Received date: 10-9-2017
Accepted date: 9-10-2017

Please cite this article as: Paul M.J. Van den Hof, Arne G. Dankers, Harm H.M. Weerts, Identification in dynamic networks, *<![CDATA[Computers and Chemical Engineering]]>* (2017), https://doi.org/10.1016/j.compchemeng.2017.10.005

Identification in Dynamic Networks

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Abstract

System identification is a common tool for estimating (linear) plant models as a basis for model-based predictive control and optimization. The current challenges in process industry, however, ask for data-driven modelling techniques that go beyond the single unit/plant models. While optimization and control problems become more and more structured in the form of decentralized and/or distributed solutions, the related modelling problems will need to address structured and interconnected systems. An introduction will be given to the current state of the art and related developments in the identification of linear dynamic networks. Starting from classical prediction error methods for open-loop and closed-loop systems, several consequences for the handling of network situations will be presented and new research questions will be highlighted.

Keywords: system identification, dynamic networks, identifiability, experiment design, model-based control, distributed control, closed-loop identification.

1. Introduction

System identification is a well-developed technology for estimating plant models from operational data, typically taken during dedicated plant testing/excitation. Data-driven estimation and maintenance of dynamic models is considered a key technology for realizing a higher level of autonomy of model-based controllers when maintaining economic optimal operation of the plant, see e.g. [6, 19, 4, 11].

The system configurations that are typically being considered are either multivariable open-loop or feedback controlled (closed-loop) systems. Whereas in open-loop identification the plant input signals are not restricted by the system, in closed-loop systems the presence of feedback induces a correlation of the plant's output disturbances with the plant input, thereby complicating the identification problem, see e.g. [10]. This has led to the development of dedicated closed-loop identification schemes [16, 5]

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