

IFAC World Congress 2023 Yokohama
Open Invited Track
Tensor Methods for Modelling and Control
(Code i8axq)

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Abstract: Tensors are a basic modelling structure for multidimensional problems in physics for more than a century. In the last decade, new results on tensor based algorithms have been achieved in modelling and control. This open invited track welcomes all application and theory related submissions showing the use of tensors and tensor decompositions for modelling, system identification, data analysis, (supervisory) controller design, fault diagnosis and reconfiguration in control engineering.

Keywords: Nonlinear system identification, Nonlinear systems, Models, Fault diagnosis, Fault Tolerance, Controller design, Model reduction, Data reduction, Multilinear systems, Polynomial systems

1. MOTIVATION

Many of today's control engineering challenges are nonlinear and/or large scale, e.g. control of distributed networks, smart grids, medical homecare, building automation systems, etc. Modelling and control problems for these applications are often hard to solve efficiently because of the curse of dimensionality and their hybrid nature, e.g. discrete-event and continuous-valued signals coexist and interact. The complexity of modelling and controller design tasks typically grows with the dimension of the problem as well as with the ability to model nonlinear behaviour.

Tensor decompositions are known since nearly 100 years, (Hitchcock, 1927), but only recently application domains like signal and image processing or chemometrics begin to profit from these ideas, (Cichocki et al., 2017). Their ability to reduce large scale problems by orders of magnitude without losing relevant information has shown to be superior to standard matrix techniques (Kolda and Bader, 2009; Oseledets, 2011).

Also in control engineering have tensor methods found an ever-growing application domain. This ranges from modelling, control, and diagnosis of multilinear time-invariant systems (Lichtenberg et al., 2022; Schnelle et al., 2022), nonlinear system identification (Batselier, 2022; Decuyper et al., 2019), up to optimal feedback control of nonlinear dynamics (Dolgov et al., 2021).

2. RESTRICTIONS

All papers in this session should be concerned with multi-index structures, i.e. problems of at least dimension 3.

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* For Evaluation: TC 1-1 Modelling, Identification and Signal Processing

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