Proposal for IFAC 2017 Open Invited Track
"Operator data-driven framework towards estimation and control"

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Abstract: Recently, there has been considerable progress in data-driven methods for systems' estimation and control. These efforts are motivated by the availability of vast data sets, emerging from large networks of sensors and data collection. In this special session, we focus on data-driven methods that exploit tools from automatic control and multivariate data modelling in order to discover systematic structures in the spatial domain, and temporal domain. The discovered structures are then used to estimate and control the system. More specifically we want to invite submissions which study operator data-driven framework for system's modeling estimation, control, and their applications to real-world examples.

IFAC technical committee for evaluation: TC 1.1 'Modeling, Identification and Signal Processing'.

Detailed description of the topic: The rapid increase in the amount of data generated by large systems is becoming a major challenge for the interpretability of these systems. A recent approach for tackling this challenge includes an operator theoretic framework for extracting the underlying dynamical structures of the system. These dynamical structures can then be used together with classical control theory to estimate and control the systems.

More specifically, we wish to gather in this session some recent results on the Koopman operator and its applications to signal estimation and systems control. Indeed, we have noticed recently an emergence of numerous efforts towards using the Koopman theoretical framework and its approximations, e.g., dynamic mode decomposition (DMD, extended-DMD, kernel-DMD), for big data processing, leading to low order dynamical structures, which can be easily merged with classical control theory for estimation and control. Such efforts have led to new data-driven modelling, estimation and control methods, with numerous real-world applications, e.g., crowd analysis, airflow and fluid dynamics modeling and control, smart-grid large networks data processing and estimation, etc.

We invite authors working on such data-driven methods and their applications to submit and discuss their new findings and challenges with the signal processing and the control community so we could together improve the research in this challenging emerging field, in the frontier of signal processing, operators' dynamical theory, and control theory.

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