GAR2023 COD 71

Reduced order modelling for resilient control of complex systems

Project Code: 71

Contract number: 260/28.11.2023

Funding: Patrimony Foundation (Fundatia "PATRIMONIU") of the Romanian Academy,

from the Recurrent Fund of Donors

Period: 01 January 2024-31 December 2025

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Abstract: The persisting unsolved problems in modelling and model reduction of complex systems have motivated us to start looking into the very nature of the underpinning topology and the way how the intrinsic (nonlinear) sparsity structure can be preserved in the model reduction step. The starting point consists of doing data-based modelling using specific tools to reveal the topology of the complex system leading to the best understanding of the systems and their interconnections in the network. Furthermore, the specific nonlinearities may come out and prove to be significant for later analysis, simulation and control design. Since the models are complex, nonlinear and huge, model reduction is performed such that the topology is weakly altered and, at the same time, desired (physical) properties are preserved most accurately. Simulations are performed as well to compare the results of the model reduction with the models extracted from data. All is done with the scope of getting the models ready for reliable control strategies. To illustrate the proposed achievements the wave PDE case is studied.

2024

Journal Papers

L. Romero-Ben, P. Irofti, F. Stoican, V. Puig. Nodal Hydraulic Head Estimation through Unscented Kalman Filter for Data-driven Leak Localization in Water Networks, IFAC Papers Online, vol. 58, no. 4, 2024

Conference Papers (peer reviewed)

T. C. Ionescu, O. V. Iftime and I. Necoara. Data-driven Loewner matrices-based modeling and model predictive control of a single machine infinite bus model. Proc. of Mediteranean Control Conference, MED2024, Crete, Greece

X. Cheng, T. C. Ionescu, O. V. Iftime. Moment matching for second order systems with pole-zero placement. Proc. of 63rd IEEE Conference on Decision and Control, CDC2024, Milan, Italy

T.G. Nicu, F. Stoican, D. Ioan, I. Prodan. Design of a Navigation Function for a Polyhedral World. Proc. of 16th APCA International Conference on Automatic Control and Soft Computing (CONTROLO2024), Porto, Portugal

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F. Stoican, S.S. Mihai, M. Mönnigmann and B.D. Ciubotaru. Energy-Efficient Trajectory Planning with B-Splines and the Schoenberg Quasi-Interpolant, Proc. of Conference on Decision and Control (CDC2024), Milan, Italy

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A. Dumitrache and T.C. Ionescu, Reduced Order Modeling for Aerodynamic and Flow Control - a brief Survey, Proc. of International Conference of Numerical Analysis and Applied Mathematics (ICNAAM 2024), Crete, Greece