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PREDICTIVE DATA-DRIVEN MODEL REDUCTION AND DISCOVERY FOR DYNAMICAL SYSTEMS

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ANDREA MANZONI[*], MENGWU GUO[‡], AND STEVEN BRUNTON[†]

[*] MOX – Dipartimento di Matematica, Politecnico di Milano, Italy
andrea1.manzoni@polimi.it

[‡] Department of Applied Mathematics, University of Twente, the Netherlands
m.guo@utwente.nl

[†] Department of Mechanical Engineering, University of Washington, United States
sbrunton@uw.edu

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ABSTRACT

The need for describing, understanding, and predicting the dynamics of complex systems has led to a multitude of numerical methods across several disciplines over the last decade, blending physics-based and data-driven techniques to different extents. Recent advances in deep learning, among many algorithmic methods of machine learning, have allowed to overcome several bottlenecks often hindered by high dimensionality, significant complexity, and chaotic behaviors, opening new horizons for data-driven predictive modeling. However, new techniques with general applicability to complex systems in science and engineering are still needed promptly.

Relying on well-established paradigms of reduced order modeling and dimensionality reduction through, e.g., autoencoders and sparsity-preserving techniques, data-driven modeling and discovery is an extremely active research area, nowadays integrating Bayesian and kernel methods for uncertainty quantification, multi-fidelity methods for data fusion, and deep reinforcement learning for controls, to name a few.

This minisymposium will gather a broad spectrum of contributions in this very vibrant research area, covering the theoretical analysis, computational techniques, and practical use of data-driven methods for the model reduction and discovery of dynamical systems, all towards efficient and accurate predictions in applied sciences and engineering.