Contribution ID: **12** Type: **Talk**

# Data-driven prediction: from LTI to NARX systems

The behavioral setting [1] is suited for data-driven algorithms since systems are viewed as sets of trajectories. A classical result in this framework, known as /Willems' fundamental lemma/ [2], states the conditions that allow to represent all the system trajectories from an observed one. This result makes possible to perform data-driven simulations [3], that is simulation of the future system trajectories directly from the observed data (without estimating a system model).
The classical theory about the topic was developed for the class of linear time-invariant systems only.
We discuss recent results [4,5] on how to switch from linear to nonlinear systems.

[1] J. W. Polderman and J. C. Willems. Introduction to Mathematical Systems Theory, volume 26 of Texts in Applied Mathematics. Springer New York, New York, NY, 1998.

[2] J. C. Willems, P. Rapisarda, I. Markovsky, and B. De Moor. A note on persistency of excitation. Syst. Control Lett., 54(4):325–329, 2005.

[3] I. Markovsky and P. Rapisarda, "Data-driven simulation and control," Int. J. Control, vol. 81, pp. 1946–1959, 2008.

[4] I. Markovsky. Data-driven simulation of generalized bilinear systems via linear time-invariant embedding. IEEE Trans. Automat. Contr., 2023.

[5] A. Fazzi and A. Chiuso. Data-driven prediction and control for NARX systems. Submitted.

**Primary authors:** Prof. CHIUSO, Alessandro (University of Padova); FAZZI, Antonio (University of Padova)

**Presenter:** FAZZI, Antonio (University of Padova)