

# Hidden structures in data-driven representations of dynamical systems

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## Abstract

Using the behavioral approach to systems theory, we derive a non-parametric representation of linear time-invariant systems, based on Hankel matrices constructed from raw data. The data-driven representation leads to new identification, signal processing, and control methods. The representation is then generalized to affine, bilinear, and parameter dependent systems. In all cases, the representation has special structure that is used for de-noising as well as for faster computations.

## References

- [Mar19] I. Markovsky. *Low-Rank Approximation: Algorithms, Implementation, Applications*. Springer, 2019.
- [Mar23] I. Markovsky. Data-driven simulation of generalized bilinear systems via linear time-invariant embedding. *IEEE Trans. Automat. Contr.*, 68:1101–1106, 2023.
- [MHD23] I. Markovsky, L. Huang, and F. Drfler. Data-driven control based on behavioral approach: From theory to applications in power systems. *IEEE Control Systems Magazine*, 43:28–68, 2023.