# Operator inference method for mechanical systems

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Mechanical systems are typically modeled by second-order differential equations.

$$\boldsymbol{M}\ddot{\mathbf{x}}(t) + \mathbf{E}\dot{\mathbf{x}}(t) + \mathbf{K}\mathbf{x}(t) = \mathbf{B}\mathbf{u}(t) \tag{1}$$

Whenever the system realization is known, model reduction using projection methods can be performed. However, in many setups, mechanical systems are modeled using legacy codes, and the dynamical equations are not accessible.
The remedy for this is non-intrusive MOR, which allows constructing low-dimensional surrogate models directly from simulated or experimental data. One recent non-intrusive approach, known as operator inference [1], consists of inferring the reduced operators by solving least-squares optimization problems using the trajectories and inputs of the original system.

In this talk, the application of operator inference for mechanical systems preserving the original system structure and properties will be discussed. The results for different benchmarks will be presented.

## References

[1] B. Peherstorfer and K. Willcox. Data-driven operator inference for nonintrusive projection-based model reduction. *Computer Methods in Applied Mechanics and Engineering*, 306:196–215, 2016.