MATTER AND TECHNOLOGIES

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Integration of Koopman theory and Autoencoders to model nonlinear systems

Many physical systems, such as wind farms, aircraft, and particle accelerators, are nonlinear, meaning their behaviour can be unpredictable and difficult to model with simple linear differential equations. However, we need linear representations of these nonlinear systems within their operating range because control design and fault diagnosis for linear systems are well-established and computationally efficient. With today's access to large amounts of data, machine learning techniques offer promising tools for system identification.
Yet, relying solely on machine learning can lead to complex, hard-to-interpret digital twins of nonlinear systems.

In this poster, I present an alternative approach that combines physical insights with data to identify a linear representation of nonlinear systems. By integrating Koopman theory and Autoencoders, we can achieve a powerful data-driven method for system identification, retaining the benefits of linear analysis while capturing the underlying nonlinear dynamics.

I invite you to explore how this integration works and how it can be applied to model the complex systems.

Speed talk:

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