

Deep learning of multibody minimal coordinates for estimation

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Multibody systems are the state-of-the-art tool to model complex mechanical mechanisms. However, they typically include redundant coordinates plus constraints, leading to differential algebraic equations for the dynamics which require dedicated integration schemes and control/estimation algorithms.

In my work, autoencoder neural networks are combined with the multibody physics information. In this way, the autoencoder does not only perform a dimensionality reduction of the original coordinates but can be used for a model order reduction obtaining a reduced-order model where the dynamics is expressed with ordinary differential equations and standard estimation algorithms can be used.

This permits to combine the physics-informed neural network with measurements in order to estimate unknown parameters or inputs in the system, for instance with an extended Kalman filtering scheme.

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