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# Multiscale systems of plasticity in a data-driven perspective: A status report

Marius Harnisch

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**Abstract**

In recent times, there has been a notable surge in the development of data-centric approaches within the realm of computational mechanics. One paradigm, known as data-driven mechanics pioneered by Kirchdoerfer and Ortiz in 2016, offers an alternative to the traditional use of material models by harnessing datasets containing matching pairs of stress and strain. The core principle involves the minimization of the distance between states found within these datasets, denoted as material states, and states that satisfy equilibrium criteria and kinematic compatibility, called mechanical states. Due to the shift to a completely data-driven approach, the paradigm offers great potential in making sophisticated modeling approaches more applicable.

We started our project with the long-term goal of a data-driven FE^2 formulation for path-dependent material behavior - a goal that required both a deep understanding of the data-driven approach itself as well as its extension to dissipative material behavior. In this contribution, we chronologically report both on our findings as well as the significant steps that we achieved. This includes insights on the ambiguous solution of the staggered approach originally proposed, said extension to inelasticity and the accompanying challenges. We also focus on a possible solution on how to cope with these challenges, namely to use a Neural Network as history surrogate.