

Data-driven mechanics – efficient and accurate solving of inelastic problems

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Abstract

Data-driven mechanics offers a new framework for the solution of boundary value problems in solid mechanics. This framework shows the appealing property that data from experiments might be included in computations directly, by eventually circumventing the step of material modelling. Furthermore, the data-driven method enables to consistently exploit data in its basic form of strain and stress from visual measurements (DIC). These two aspects open new possibilities but also interesting questions which are related to data science and classical material theory, especially in the case where inelastic materials are considered.

In particular, this lecture will address different issues regarding efficiency and accuracy of the solver. An efficient way to handle data sets of billion points and more in computations is presented. Additionally, the incorporation of machine learning techniques like tensor voting in the solver is made in order to improve the accuracy for sparse data sets. In general, this procedure makes it possible to reach a higher order convergence with respect to the data set size. Further applications are related to procedures to include information about the material deformation history.