9th GACM
Colloquium on Computational Mechanics
for Young Scientists from Academia and Industry
September 21 to 23, 2022 in Essen, Germany

MS 07
Data-driven computational modeling of mechanical behavior of materials

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Data-driven approaches are opening new pathways at the intersection of Materials Science and Computational Mechanics, driving the scientific efforts to further explore the known boundaries of mechanical performance in materials and structures. A pivotal shift towards data-driven modeling techniques has been materialized over the recent years, enabled by coupling machine-learning algorithms (deep, manifold, reinforcement, transfer, etc.) with traditional computational methods (FEM, BEM, isogeometric analysis, etc.). This class of novel numerical methods is used at the forefront in areas where either data is becoming increasingly available but no prior physical knowledge of the problem exists, or on the other hand data sparsity dominates the complexity of the problem. In these cases, such hybrid numerical algorithms can be particularly efficient in the effort to uncover hidden physical laws or design advanced multi-scale materials with unprecedented properties. This minisymposium aims to reflect the current state of the art in data-driven computational mechanics methods and their applications in material design and characterization. Topics of particular interest for this minisymposium include, but they are not limited to, the following:

- Forward and inverse design of materials by coupling machine-learning and structure-property mapping
- Assessment of errors, uncertainties and sensitivities on physics-based data-driven models
- Assessment of the impact of defects, imperfections and inclusions in material mechanics
- Introduction of physics constraints within machine-learning techniques
- Development of data-driven surrogate models
- Development of enhanced solution algorithms aimed at the reduction of the computational costs associated with the data-driven computational models
- Verification and validation of data-driven computational models