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DATA-DRIVEN, DATA-BASED AND ARTIFICIAL INTELLIGENCE METHODS IN COMPUTATIONAL MECHANICS

Georgios E. Stavroulakis

Technical University of Crete,
Chania, GR-73100 Greece
gestavr@dpem.tuc.gr

ABSTRACT

Usage of artificial intelligence methods and especially feedforward artificial neural networks which can be trained by the backpropagation method has a long history in mechanics. By using input-output examples experimentally generated or numerically calculated, direct and inverse problems in mechanics can be studied [1-4].

Complicated metamodels can be created, which represent the constitutive material relation of composite materials or materials with microstructure and further integrated into multi-scale techniques for the efficient calculation of composite materials with nonlinear behaviour [5]. Alternatively data can be used within structural analysis steps in order to exploit available experimental data [5].

Furthermore, the differential equations of mechanics can be used, in combination with automatic differentiation of the neural network, in order to create training examples and replace the need of separately calculating them. The physics-informed neural networks emerge, suitable for quick solution of direct and inverse problems [6-8].

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