A Machine Learning Approach for Probabilistic Evaluation of Finite Element Analysis

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Finite element structural analysis (FEA) is widely used in the aerospace industry to assess stress distributions in complex components. Probabilistic methods such as sensitivity analysis or optimization rely on many evaluations of the analysis. The number of realisations is limited by available time and computational resources.

In this presentation, deep neural networks (DNN) are used to replace the finite element method for the determination of stress fields. The design and in particular the input parameters required to build such a model for data generated with a Monte-Carlo-Simulation are highlighted. The presented approach is validated with analytical and numerical results of a 3D finite element model of a beam on two bearings. Mises stresses, the DNN approximation and the approximation errors are presented at local and global levels. The capabilities of the method are further shown through a sensitivity analysis using the coefficient of importance.