Machine learning-based methods for predicting the manufacturability and properties of deep-drawn components and assemblies

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Deep drawing, clamping and joining processes play a significant role in modern manufacturing technology. However, optimizing and understanding these processes is a complex task that is influenced by numerous variables. This talk presents an innovative approach to predicting and optimizing these manufacturing processes using the example of an assembly through the use of artificial intelligence (AI).

The aim is to link machine learning models to analyze, predict and optimize the complex manufacturing of the assembly. The models were trained using extensive data sets in the production of a demonstrator assembly, which is intended to represent a production environment as realistically as possible.

The results show, for example, high accuracy in predicting deep drawing simulation results including springback. Using the AI model for the deep-drawing process, the FE simulation can be completely replaced for this demonstrator component. As a result of this AI prediction, an FE model with realistic sheet thickness distributions, plastic strain fields and production-related deformations is available for the subsequent processes clamping and joining.

Finally, a combined AI model is discussed which, based on the deep drawing AI model, provides forecasts for the deformations of the complete component group.