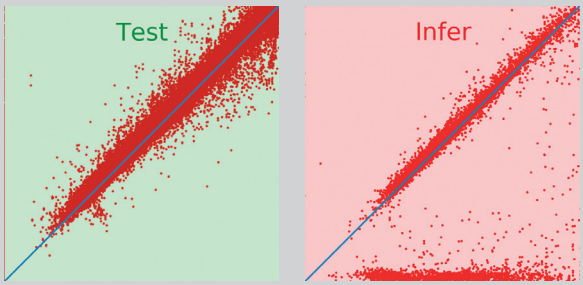
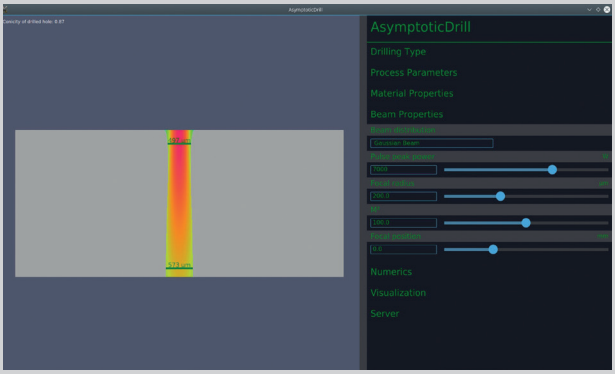


3



4

RESIDUAL NEURAL NETWORKS FOR RAPID PREDICTION OF DRILLHOLE TAPER

Task

Artificial neural networks and especially deep artificial neural networks have been used successfully in image processing for quite some time. Since they are able to map strong nonlinearities, these networks are attractive for making predictions in production engineering. One hurdle that has to be overcome, however, is that data is often scarcely available. This issue could be solved by enriching experimental data with simulated data, but before the industry can apply artificial neural networks as tools, their prediction quality must be assured and computation time reduced.

Method

The existing drilling model AsymptoticDrill can generate sufficient data in sufficient quality. Based on these simulation data, a neural network can be trained and evaluated to then approximate the drilling model. Subsequently, numerical errors are determined and run-time experiments are performed.

Results

The trained network approximates the drilling model in sufficient quality. The calculation time is shorter than the model by a factor of 140. The relationship between training data and approximation quality can be analyzed to provide criteria for the selection of training data.

Applications

The methodology can be transferred to other manufacturing processes for which sufficient data of sufficient quality are available. The approximation of the data is a regression task that can be solved by training the artificial neural network.

The work was carried out at RWTH Aachen University as part of the federal and state excellence strategy »EXC 2023 Internet of Production« and funded by the German Research Foundation (DFG) e.V.

Contact

Christian Heinigk M. Sc.
Telephone +49 241 8906-610
christian.heinigk@nld.rwth-aachen.de

Prof. Wolfgang Schulz
Telephone +49 241 8906-204
wolfgang.schulz@ilt.fraunhofer.de

3 Conicity and prediction of the neural network.
4 Simulation tool AsymptoticDrill.