Utilization of Digital Twins in a rolling plant for Aluminium

Dr.-Ing. Kai F. Karhausen

Senior Scientist, Speira R&D, Bonn

Abstract

With the integration of previously independently treated process steps and the capabilities of managing and analyzing increasing amounts of data and making them available in Cloud-Systems, new opportunities arise with respect to producing semi-products with targeted properties.

Successful applications of i4.0 concepts in industry or in pilot applications mostly treat complex logistic problems coupling different processes which are usually relatively short and independent of each other. The operation of a rolling plant for aluminium semi-products is of a different nature. The product runs through a very long process chain and changes various properties on its way, while each further step strongly depends on the previous ones. Due to the lack of non-destructive on-line sensors for many properties, a continuous tracing of the product quality development cannot be realized and thus, a consistent monitoring and training of machine learning algorithms is not possible. The industry usually relies on fixed and qualified production recipes leading to the desired final quality based on experience.

To achieve a more flexible and targeted production, digital twins are needed for the operating equipment, for the coils and for further components such as work rolls, which interact in a virtual environment. The pilot case in this presentation is a complete processing line for the production of thin aluminium foil. The main components are logistic information and sensor data from the plant, coupled with physical process and material models, implemented in a cloud environment. The application of the digital twins is targeted at improving the consistency of the production and offers possibilities to plan processes more accurately and to react on deviations in the process chain in a flexible manner.

The concept and set-up of the system is described and some use cases are discussed here. Finally, also still open questions are addressed, such as the data quality and maintenance and the digital twin quality and interactions.