

## Digital Twin for Optimization of Industrial Hot Rolling

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Market pressure and environmental sustainability are placing increased demands on steel producers to constantly optimise their production processes. In the context of Industry 4.0, digitalisation is crucial in order to remain competitive and sustainable.

With this in mind, in the project Optimization of the carbon footprint of steel with digital twin of hot rolling (PETRA) a digital twin has been set up to optimise the process parameters in the hot rolling process, which can be used to predict the microstructural properties of the material and optimise them for the efficient use of industrial equipment. With improved control and manageability of the hot rolling process more efficient production and better material and energy efficiency can be achieved. To ensure sustainable optimisation, the digital twin TMProSim was created with the integration of various special models. A thermomechanical hot rolling model and a tool for predicting the microstructure were used in the digital twin. The TMProSim digital twin is now used as a support/expert system that enables the calculation of more accurate technological process parameters, which are later used as input data for equipment management systems, significantly improving the efficiency of the technological process of hot rolling in terms of energy consumption. The digital twin of hot rolling TMProSim is used to determine the optimal process chain of hot processing within the framework of known technological equipment. In the digital twin, the microstructure is predicted according to the selected thermomechanical conditions, whereby the thermomechanical model of hot rolling is based on the finite element method and the model for predicting the microstructure is coupled in a single tool. The use of the digital twin already leads to a reduction in subsequent thermal heat treatments and a significant reduction in energy consumption with the aim of reducing the environmental impact.

Acknowledgements: Funded by the European Union, NextGenerationEU