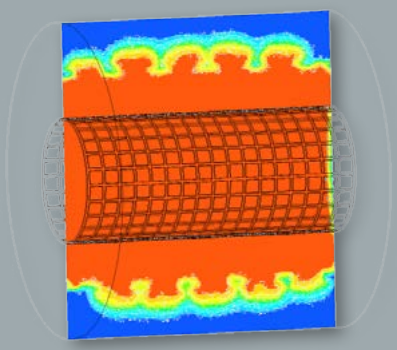

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MACHINE LEARNING IN TEXTILE MANUFACTURING

1 *CFD simulation of a virtual bobbin in a dye bath*

2 *Colored bobbins in textile production*

Today, we see dramatic changes in the demands being made of the textile industry. The trend in many areas is towards customization, similar, for example, to buying a new car. Consumers increasingly demand tailor made products. This shift in consumer behavior is lucrative for European textile companies as production of customer-specific products in small lot sizes results in the return of manufacturing to Europe. However, this requires the digital transformation of production, which we support with our hybrid simulation-based machine learning (ML) methods.

Data-based machine learning by itself is not sufficient

In data-based machine learning, we develop statistical learning algorithms that recognize patterns and laws in given data. The benefits of ML algorithms depend to a great extent on the quality and quantity of the available data. As a rule, enough measured data is collected for the purpose of quality assurance in the textile industry. However, only in the rarest of cases is sufficient data available to make a connection between the process parameters and the product quality. Consequently, we are not able to use pure, data-driven machine learning – especially for plant and process optimization for today's customized production processes.

Hybrid simulation-based machine learning

To design and optimize production processes in the textile branch with ML methods, we develop and apply a hybrid approach. Extensive experience is available for process and product design in textile industry. We formalize this expert know-how by building a physical model to describe the process and, subsequently, implement a computer based simulation. Models provide the missing data for the development of suitable ML algorithms and linking with available measurements. In this concept, ML closes the gap between physical based simulation of production processes and the level of quality of the end products – which, in many cases, is not accessible to physical models.

The optimization of winding machines with regard to a better dyeing of the wound bobbins illustrates this innovative hybrid ML process in AiF's DensiSpul project.