



***On the Way to a Digital Twin for Solid Bowl Centrifuges:
Advantages of Multiscale Modeling***

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Digitalization is now finding its way into the process industry and is an important tool for making product and process development more flexible and implementing specific customer requirements in the shortest possible time. Simulation methods and machine learning in particular have enormous potential for systematic and hierarchical product development that considers raw materials, supply chains, and higher-level goals such as resources and energy efficiency. This presentation refers to the development of digital twins for solid bowl centrifuges and illustrates the current state of development and future trends. The approach presented here is based on different time and length scales. CFD-simulations on the particle level, for example, make it possible to generate very detailed information about the process behavior, while the complex material behavior of finely dispersed particle systems can additionally be integrated into the simulation by combining it with separation-related material functions (sedimentation behavior, compression behavior, shear compaction). Additionally, dynamic modeling allows to predict the process behavior of solid bowl centrifuges in real-time, which enables the systematic process optimization but also employee training. The integration of dynamic models into the model-based control design reveal new opportunities in centrifuge operation which are based directly on particle properties (e.g. particle size distribution, composition or solids content). One of the most important prerequisites for an efficient control concept is the use of on-line and in-situ process analytics to determine the particle properties during operation. Finally, the presentation shows applications and future fields of application of the concept.