Digital twin for a real time decision support system
for the reduction of production breakdowns

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The operation of an industrial chemical process involves a large number of physical parameters that need to be controlled in order to guarantee efficiency and safety. The automated measurement of this complex system in conjunction with an intelligent use of this data is the aim of the Industry 4.0 trend. This work presents a pilot project for a real-time decision support system for the dosing of an industrial chemical feed vessel using a digital twin. The digital twin models the flow from the feed vessel to the main chemical reactor, providing the operator with information like the entering flow rate or the estimated process duration. Furthermore, by comparing the simulation results to real-time measurements, it is possible to detect abnormal behaviors of the dosing unit, like a leakage or malfunction of the dosing valve.

Based on the physical parameters collected in real-time during the first minutes of the process (fluid height, fluid temperature, valve opening), the digital twin could also allow to check whether the liquid being processed corresponds to the expected one, given that their flow difference is sufficiently large.

The digital twin is built using Simcenter Amesim, a system simulation software from Siemens [1]. A native API for the Python programming language allows to control the simulation and to collect the real-time data easily. The use of an industrial simulation software gives flexibility to later adapt the model to different systems.

This works presents the elements composing this decision support system, including the automated real-time measurement network of the installation, the script based control of the simulation and the use of the measurement data and the user interface.

[1] https://www.plm.automation.siemens.com/global/en/products/simcenter/