PROCESS CALIBRATION- THE MISSING LINK BETWEEN AN RTM-PRODUCTION LINE AND ITS DIGITAL TWIN

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Today's buzzwords such as "Industrie 4.0" and "Factory of the Future" suggest that modern machines are self-organized, self-trained and self-sufficient. Every bit of information will securely be saved and communicated in the right way. It slowly runs out of focus, that the initial information itself could still be incorrect or false. Especially for composite manufacturing, keeping the process within the right range of parameters is elementary, since there is now way for correction after curing.
Automation needs sufficient utilization to work economically effective. Due to variation diversity and only few equal parts in aerospace applications, producing different parts at lot size 1 becomes mandatory. It has to be ensured, that machines are working correctly, even before starting the process. Therefore the current state of every component and the actual/target deviation has to be well known.

Calibration is the key not only for reliable analytics, but also for reliable production. Every laboratory in pharmacy, food or chemical industry has to check the correct functionality of analytical equipment. Scales are checked by calibration weights, other devices by reference samples. DLR transfers this approach to an automated production line: EVo research platform for net shaped RTM parts, located in Stade, Germany. EVo's digital twin contains a 3D-model of the plant that will gather and visualize all machine and sensor data. In future, this data will also be used for simulation purposes and predictive maintenance, as well as cost and quality assessment. To manage the machine's data is only one part of the story, though. To understand what it does to the part being produced is the real challenge. The first step is measuring process parameters from the product’s point of view. Therefore a calibration part containing various sensors is developed. Measured temperature and pressure distributions, accelerations and elongations will be compared to machine data on the one hand and to a reference process that lead to a perfect part on the other hand. The deviation between nominal and actual values is not only caused by sensor inaccuracy and interface influences, but also by each part's geometrical and material properties. By understanding these interactions a truly transparent process can be achieved. The result will be the digital twins of both, product and factory, that carry every relevant aspect of the real process. This enables reviewing the whole production process anytime anywhere.

Figure 1: Digital Twin of RTM production line "EVo"

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