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Development of SMA high load actuators from a manufacturing perspective

The presentation advances the knowledge of the specific thermal and material behavior in high load SMA-Actuators. Due to their small volume and weight, these actuators provide an atractive alternative to conventional actuators. Especially in production plants and machines, where the requirements for installation space and weight are becoming increasingly crucial for a successful manufacturing process, they find a wide field of application. Quite in contrast to small force applications, more massive geometries and new integration concepts of the shape-memory- components (SMC) are substantial. However, well developed semi-finished products are not yet available. Furthermore, this changes mechanical and functional cycle fatigue, an issue well known from wire based small force SMA-Actuators. Moreover, thermal behavior changes drastically with the more massive geometries. Comprehending how these changes significantly alter the SMA behavior will eventually enable novel designing and optimizing. Therefore, a universal high load SMA-Actuator, has been designed for integration in high load applications such as machine tools. Here, an introduction of the actuator as well as a look into the thermal design and challenges is given. Moreover, the cyclic behavior of the SMC is investigated, using this high load SMA-Actuator. The SMCs, cycled in the SMA-Actuator have been manufactured with different methods. Here, a classical manufacturing process is compared to an additive process (PBF-LB/M). The additive processed SMCs show microcracks and pores. Nevertheless, the cyclic properties exceed those of the classical processed specimen in all measured properties. Especially the tiny hysteresis, low shortening of the SMC can be highlighted.

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