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DESIGN FOR FUNCTIONAL INTEGRATED SHAPE MEMORY ALLOY SYSTEMS

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Abstract

Actuators based on shape memory alloys (SMAs) are developed to be used only in special applications. Therefore solutions based on SMAs in general, cannot be transferred to other tasks. The focusing only on the development for special applications has two important disadvantages. Firstly the effort and costs reach a high level due to the individual development and secondly the development of complex SMA-actuators turns out to be an insuperable barrier for many companies. Reasons are the complex characteristics and the missing simulation- and design tools. In order to make statements about the functions and durability of the SMA-component extensive tests need to be performed.

As a result there is significant interest in providing standardized SMA-actuator systems with complex and also variable functions. Construction kit systems allow transferability to different areas of application and they also lead to a reduction of variants. Using standardized components is an interesting opportunity to reduce the risk of individual development and the effort for single applications effectively. However the increased system complexity of conventional construction kit systems is a problem (additional functions required, e.g. the mechanical and electrical coupling of the modules). Apart from the conventional form of a construction kit system there is the possibility of a variable SMA-actuator system generated by the configuration of a single SMA-component. The existing and unique potential of SMAs for function integration and therefore standardization can be used to its full extent.

The aim of this paper is to provide methods and the knowledge to support the development process of such SMA-structures. The development of these methods is based on the analysis of designs of smart structures and potentials for function integration were also derived. Based on the results, instructions for the conception of integrated SMA-structures were created in order to find feasible solutions. The most important factor is the achievable level of function integration.