DYNAMIC ACTUATION OF A MULTIPLE MEMORY MATERIAL PROCESSED NITINOL LINEAR ACTUATOR

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Shape memory alloys such as Nitinol, which is a group of NiTi alloys composed of nearly equiatomic nickel and titanium, finds increasing applications in many industries because of its unique properties including the shape memory effect and pseudoelasticity. In past work simple linear actuators have been developed using Nitinol wire which are actuated and controlled using resistive heating. However, traditional Nitinol materials are batch processed and a monolithic component only possesses a single set of transformation temperatures, limiting the functionality of the actuator. In this work a linear actuator processed using the novel multiple memory material processing technology is presented showing multiple transformations and dynamic actuation by resistive heating. This dynamically controlled actuation greatly improves the functionality of the Nitinol actuator allowing for the realization of new applications and improved control methods. The different transformation temperatures embedded in the monolithic wire actuator following processing are identified using thermo-analytical analysis and the dynamic application of load and displacement are presented using a custom test set-up.