

Different Orientations of Shape Memory Alloy Wire in Automotive Sector Product

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Abstract : Shape Memory Alloys (SMA) are widely known for their unique shape recovery properties. SMA based actuation systems have high-force to weight ratio, light weight and also bio-compatible material. Which is why they are being used in different fields of aerospace, robotics, automotive and biomedical industries. However, in the automotive industry plenty of patents are available but commercially viable products are very few in market. This could be due to SMA material limitations like small stroke, direct dependability of lifecycle on stroke, pull load of the wire and high cycle time. In automotive sector, SMA being considered as an actuator which is required to have high stroke and constraint arises to accommodate a long length of wire (to compensate maximum 4 % strain as per better fatigue life cycle) not only increases complexity but also adds on the cost. More than 200 different types of actuators are used in an automobile, few of them whose efficiency can highly increase by replacing them with SMA based actuators which include latch lock mechanism, glove box, Head lamp leveling, side mirror and rear mirror leveling, tailgate opener and fuel lid cap actuator. To overcome the limitation of available space for required stroke of an actuator which leads to study the effect of different loading positions on SMA wires, different orientations of SMA wire by using pulleys and lever based systems to achieve maximum stroke. This investigation summarizes the loading under the V shape orientation the required stroke and carrying load capacity in more compact in comparison with straight orientation of wire. Similarly, the U shape orientation its showing higher load carrying capacity but reduced stroke which is aligned with concept of bundled wire method. Life-cycle of these orientations were also evaluated.

Keywords : actuators, automotive, nitinol, shape memory alloy, SMA wire orientations

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