SMA-powered Non-Magnetic Actuator

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Instructor: Prof. Sushma Santapuri

Abstract

Exploring new horizons in actuator technology, we present the SMA-based bipennate actuator, blending the unique attributes of shape memory alloys (SMAs) and biological pennate muscles. This integration offers a superior power-to-weight ratio and finds applications across diverse fields, from building controls to precise drug delivery systems. This highlights the potential for innovative solutions through the synergy of existing concepts, paving the way for enhanced automation and precision in various industries. Our project work is based on [1].

Team Members

- Aditya Agrawal (2021AM10198)
- Swapnil Kashyap (2021AM10782)

Objectives

- We will begin with a comprehensive literature review to understand the current state of hierarchical actuator systems, shape memory alloy (SMA) technology, and related mathematical models.
- After this, we plan to develop the constitutive model for SMAs, phase transformation equations, and other relevant mathematical formulations.
- We also aim to simulate the Constitutive Model, Heat Transfer Model, Phase Transformation Model, Dynamics and Kinematics Model on Simulink.
- Lastly, if time permits, we wish to work on the fabrication of the prototype actuator system using the specifications and design details provided in the paper and test the system's response to different parameters, as well as its efficiency and stroke under various conditions.

References

[1] Kanhaiya Lal Chaurasiya, A. Sri Harsha, Yashaswi Sinha, and Bishakh Bhattacharya. Design and development of non-magnetic hierarchical actuator powered by shape memory alloy based bipennate muscle. *Scientific Reports*, 12(1):10758, 2022.