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Title: Frequency response analysis of shape memory alloy actuators

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Abstract

This paper presents a frequency response analysis of nickel-titanium Shape Memory Alloy (SMA) wires that are the active elements in an SMA actuator. Frequency response analysis is the measurement of the relative magnitude and phase of an output signal, with respect to an input signal, at spot frequencies covering a frequency range of interest. In this case, the input signal is the electrical heating power applied to the SMA wire, the output is the tensile force on the wire, and the frequency range is 0.1 Hz to 100 Hz. The purpose of such measurements is to obtain a transfer function, relating power input to force output, that can be used to design a feedback control system for a precision SMA force actuator. Measurements are presented for wires having diameters of 75, 100 and 125 μm , in ambient air at room temperature, under various combinations of stress and strain. It is shown that the phase response is independent of stress and strain, while the magnitude response varies by about 7 dB.

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