عنوان مقاله:

Thermoelectric Heat Transfer Modeling of Shape Memory Alloy Actuators

محل انتشار:

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خلاصه مقاله:

Shape Memory Alloy (SMA) wires used as an actuator, are usually actuated by resistive heating of electrical currents rather than by the surrounding medium. Owing to difficulties in control of electrically-heated SMAs, the thermoelectric heat transfer of SMA wires is undertaken in this paper. First-order convective heating model is used for thin SMA wire which accounts for the latent heat and thermal hysteresis of transformation. The convective heat transfer coefficient, h, is assumed to be a polynomial function of temperature. In addition, heat capacity is defined as a function of both temperature and stress. A one-dimensional constitutive model of Brinson is applied to determine stress in the wire. The electrical heat transfer equation is coupled with the constitutive equation to simulate the constant strain behavior of the SMA wire. Based on this simulation, a simplified model is proposed to predict the temperature response of SMA wire in order to calculate the time response of SMA actuated systems. A series of experiment are performed in which the transient temperature data are recorded for different applied electric current profiles to validate these two models. For different current input profiles, the calculated time response is in good agreement with the experimental data. The developed models may be applied in order to predict the temperature of a current carrying SMA wire without using direct temperature measurement methods.

کلمات کلیدی:

Convection, Heat transfer, Shape Memory Alloy