ABSTRACT

Structural topology design of thermal actuator using compliant mechanism

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A compliant mechanism is the mechanism that relies on its own elastic deformation to transfer or transform motion or force. Common compliant mechanisms function under the application of force at certain location (input) and generate desired force or deflection at another location (output). Thermally actuated compliant mechanisms are those compliant mechanisms, onto which thermal loading is applied as input instead of force. In heat-activated compliant mechanisms, the deformation is caused by thermal expansion of material due to change of temperature distribution. Because of its complexity in heat transfer and thermal-elastic analysis, it is difficult to expect the configuration of a thermal actuator *in prioi*. Previous works on designing a thermal

actuator have not considered effects of convection heat transfer at the boundary or have used interpolated convection properties.

In this work both conduction and convection heat transfer analysises are carried out to consider the steady state response of a thermal actuator. Flexibility and stiffness of a structure are formulated using a compliant mechanism concept and topology optimization is applied to determine the structural layout of a mechanism. The multiobjective optimization problem is solved by sequential linear programming and the filtering algorithm is employed to avoid checkerboard patterns.

Design examples of a snap-fit mechanism, a thermal actuator and the Guckel-actuator are presented to validate the proposed method.

The optimal results are utilized to generate the structural configuration of a thermal actuator and the performance is confirmed by conducting thermo-mechanical analysis using ANSYS.