ABSTRACT

Design of compliant mechanism with geometrical advantage

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A compliant mechanism is a mechanism that produces its motion by the flexibility of some or all of its members when the input forces are applied. Because of its mobility resulted from flexibility, it is difficult to expect the configuration of a compliant mechanism *in prioi*. Previous works on designing a compliant mechanism include a method using a pseudo-rigid-body model, an approximation of the rigid-body model and a method using a multi-criteria model with the topology optimization technique. Since these methods are only based on maximizing performance of a mechanism, the accuracy of the motion generated by a compliant mechanism is not guaranteed and additional efforts are required to fulfill the functionality.

In this study, the design method of a compliant mechanism with specified geometrical advantage is proposed. The optimization problem is formulated to minimize the difference between the specified and the current geometrical advantage of a mechanism and topology optimization is applied to determine the layout of a mechanism. To have enough stiffness of a complaint mechanism, the minimization of mean compliance at an input and an output ports is added to the objective function of the formulation. Also, since unexpected displacements at an input and an output ports can be generated, the minimization of unexpected displacements is also added to the objective function. The optimization problem is solved by sequential linear programming and the filtering algorithm to avoid checkerboard patterns is used.

The results of several test problems including the displacement converter design and the gripper design are compared with a multi-criteria model and show that the design of an accurate compliant mechanism with specified geometrical advantage can be obtained.