World Academy of Science, Engineering and Technology
International Journal of Aerospace and Mechanical Engineering
Vol:10, No:12, 2016

Design and Optimization for a Compliant Gripper with Force Regulation Mechanism

Authors : Nhat Linh Ho, Thanh-Phong Dao, Shyh-Chour Huang, Hieu Giang Le

Abstract : This paper presents a design and optimization for a compliant gripper. The gripper is constructed based on the concept of compliant mechanism with flexure hinge. A passive force regulation mechanism is presented to control the grasping force a micro-sized object instead of using a sensor force. The force regulation mechanism is designed using the planar springs. The gripper is expected to obtain a large range of displacement to handle various sized objects. First of all, the statics and dynamics of the gripper are investigated by using the finite element analysis in ANSYS software. And then, the design parameters of the gripper are optimized via Taguchi method. An orthogonal array L₉ is used to establish an experimental matrix. Subsequently, the signal to noise ratio is analyzed to find the optimal solution. Finally, the response surface methodology is employed to model the relationship between the design parameters and the output displacement of the gripper. The design of experiment method is then used to analyze the sensitivity so as to determine the effect of each parameter on the displacement. The results showed that the compliant gripper can move with a large displacement of 213.51 mm and the force regulation mechanism is expected to be used for high precision positioning systems.

Keywords : flexure hinge, compliant mechanism, compliant gripper, force regulation mechanism, Taguchi method, response surface methodology, design of experiment

Conference Title : ICAMAME 2016 : International Conference on Aerospace, Mechanical, Automotive and Materials Engineering

Conference Location : London, United Kingdom

Conference Dates : December 15-16, 2016