ETSRB003-2017 A Cable Driven Flexible Robotic Grasper with

Lego-like Modular and Reconfigurable Joints

Abstract

This paper proposes a Modular and Reconfigurable Cable-driven robotic grasper (MoReCa Grasper) for grasping diverse unknown objects in unstructured environments, which integrates the characteristics of full actuation and underactuation. The mechanical design of this robotic grasper is introduced with a focus on its Lego-like modular design feature and reconfigurable flexible joints. With these features, the length of this robotic grasper can be arbitrarily changed through the addition or removal of the Lego-like finger modules connected by magnets without rerouting or breaking the cables. The shape and degree of freedom (DOF) of the robotic grasper can be adjusted by changing the states of the joints using embedded clutches. When the joints are locked, the grasper can maintain its shape without additional power from actuators leading to better energy efficiency. The kinematics, workspace, and contact force are analyzed. On this basis, an automatically reshaping method (ARM) based on the motor's current during the operation is proposed. Lastly, an example prototype of the robotic grasper with two fingers (four modules each), is built and tested. In the first experiment, the maximum grasping force is obtained. The second experiment demonstrates the ability of grasping diverse objects via changing the number of the modules and presetting the shape of the robotic grasper. The effectiveness of the ARM is verified in the third experiment