Application of permanent magnet and magnetorheological fluid in the finger pads of a jaw gripper

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Soft grippers are constantly in the interest of researchers [1] due to their gripping properties and adaptability. On the other hand well-known kinematic structures of rigid grippers allow for precision and force exertion [2]. Still an undiscovered topic is the combination of these structures into a hybrid soft-rigid gripper using magnetorheological (MR) fluid [3]. This creates the potential to develop the subject of grippers equipped with setup that interacts with MR fluid and magnetic field sources capable of changing its properties. Solutions in this case include designs such as the universal jamming gripper [4] and cushions on the parallel jaw gripper [5].

This publication discusses the solution of a novel MR fluid cushion system which is a soft element that is flexible and mounted on a rigid jaw gripper. The MR fluid cushion setup structure is based on a permanent magnet inside a yoke, a spring unit and an MR fluid cushion made of thermoplastic polyurethane. This is an interesting application of magnetism to perform object manipulation tasks. In this case, changing the distance of the permanent magnet changes the properties of the MR fluid. When the cushion makes contact with the object to be grabbed, a magnetic field is applied to the system, resulting in a stiffening of its structure. Retracting the jaws moves the magnet away and weakens the magnetic field inside the cushion. The publication includes a description of a novel MR cushion setup along with finite element method studies for magnetic applications.

References:

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