

Multifunctional gripping systems fulfil rough industrial demands

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Industrial gripping systems are used mainly to handle a specific object selection with defined dimensions. In consequence the gripper's degree of freedom is restricted and it is equipped with adapted, customized and stiff fingers. Hard industrial demands like a robust exterior, long life under hard use, water- or dust-proof are fulfilled. Vacuum grippers can pick and place objects of differing appearance but are unable to re-establish a precise position for mounting or joining the gripped object. Although they have only a restricted ability of object manipulation one advantage of mechanical gripping systems is a reliable geometric alignment after the gripping process. In an industrial environment objects of varying dimension, weight and geometry are handled using automatic change systems for grippers to be adapted to a robot system.

Different promising developments of multifunctional grippers / hands have been presented in the last fifteen years. The common aim still now is to overcome the restrictions in gripping variety in order to cover as many gripping problems as possible in a wide field of applications. Often the human hand serves as an example leading to an anthropomorphic design. SCHUNK participates in the publicly promoted research project called DESIRE. The goal of this partnership is a service robot mainly used in an office and home environment. The demand for gripping systems delivered by SCHUNK is first of all to grip as many objects of every day life as possible and therefore it has to adapt to an enormous variety of objects. The technical background of such hands is an expensive electromechanical system with at least thirteen independent motions. The controllers of the motors will be bonded with each other via bus communication. However, due to the fact that the hand will interact with people, a main point of development is the aesthetical appearance as a serving device. In general, such an anthropomorphic hand will not fit into an industrial environment, e. g. mounted on the front end of an industrial robot. A multifunctional gripper with a human-like appearance would be rather disturbing.

Parallel to gripping hands for service robotics SCHUNK has developed a multifunctional industrial gripper in a bilateral co-operation with the Institute for Process Control and Robotics (IPR), University of Karlsruhe. (see their respective paper). Principally, for industrial purposes the design is a consequence of performance and power density but a professional design harmonised with a best fit to usage and service is appreciated nevertheless.

A modular system with electrically driven joints and defined interfaces as motion modules has been worked out. The motion is driven by motors from Faulhaber and gear boxes from Harmonic Drive. Part of the water-proof concept is that all electrical connection cables are completely integrated. The position of every joint is measured absolutely. All modules are equipped with electrical connectors. Two different torque forces up to 4.8 Nm have been

worked out e.g. for a base and a distal joint of a finger. The joint elements are combined by light weight profiles variable in length. As an option a tactile sensor can be adapted on every interacting surface of the gripper.

Prototypes of both developments will be shown in action at the AUTOMATICA exhibition: The anthropomorphic hand for service robots as well as the multifunctional gripper for industrial tasks.



Figure 1: Model of the anthropomorphic hand (German Aerospace Center)



Figure 2: Model of the multifunctional gripper (SCHUNK)

Another innovation is a very flat manual tool changing system, the result of a cooperation with the German Aerospace Center. It includes an electrical feed-through in the center and is easy to use. The mounting plate is compatible to the standardised interface for robots ISO 9409-1.