The project SOMA is funded by the eighth framework program Horizon 2020 of the European Union (H2020-ICT-645599) and is a cooperation between the following institutions:

Technische Universität Berlin

ISTITUTO ITALIANO DI TECNOLOGIA

Centro E. Piaggio
bioengineering and robotics research center

DLR
Deutsches Zentrum
für Luft- und Raumfahrt
German Aerospace Center

ocado

Disney Research, Zurich

IST AUSTRIA
Institute of Science and Technology

Project duration: 05/2015-04/2019

Twitter @soma_H2020

soma-project.eu

DLR at a glance

DLR is the national aeronautics and space research centre of the Federal Republic of Germany. Its extensive research and development work in aeronautics, space, energy, transport and security is integrated into national and international cooperative ventures. In addition to its own research, as Germany's space agency, DLR has been given responsibility by the federal government for the planning and implementation of the German space programme. DLR is also the umbrella organisation for the nation's largest project management agency.

DLR has approximately 8000 employees at 20 locations in Germany: Cologne (headquarters), Augsburg, Berlin, Bonn, Braunschweig, Bremen, Bremerhaven, Dresden, Goettingen, Hamburg, Jena, Juelich, Lampoldshausen, Neustrelitz, Oberpfaffenhofen, Oldenburg, Stade, Stuttgart, Trauen, and Weilheim. DLR also has offices in Brussels, Paris, Tokyo and Washington D.C.

Imprint

Publisher:
German Aerospace Center (DLR)
Institute of Robotics and Mechatronics

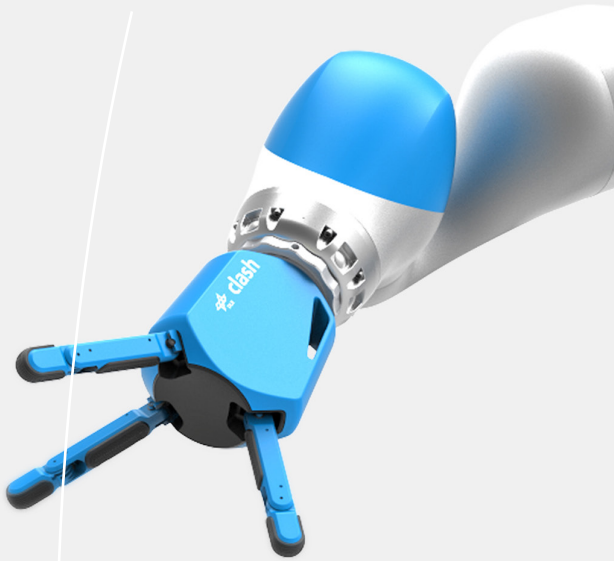
Address:
Hannes Höppner
Münchner Str. 20, 82234 Weßling
Phone + 49 8153 28-3571
e-mail hannes.hoeppner@dlr.de

DLR.de

DLR Deutsches Zentrum für Luft- und Raumfahrt
German Aerospace Center

Supported by:
Federal Ministry for Economic Affairs and Energy
on the basis of a decision by the German Bundestag

SOMA_GB_06/2018



soma
SOFT MANIPULATION

SOMA
Soft-bodied intelligence for **Ma**nipulation

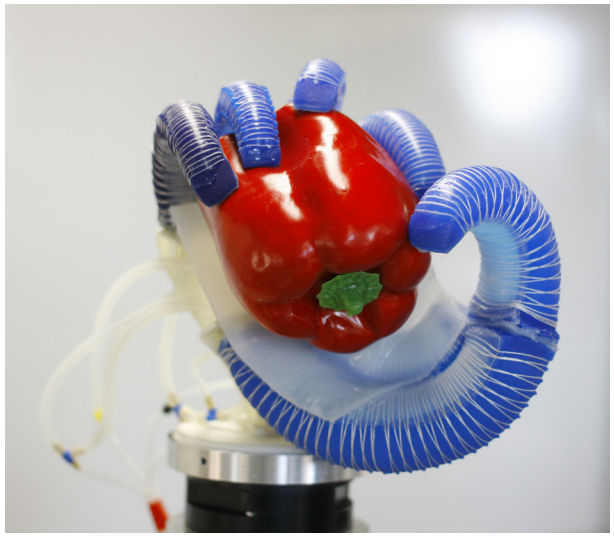
DLR

The SOMA Project

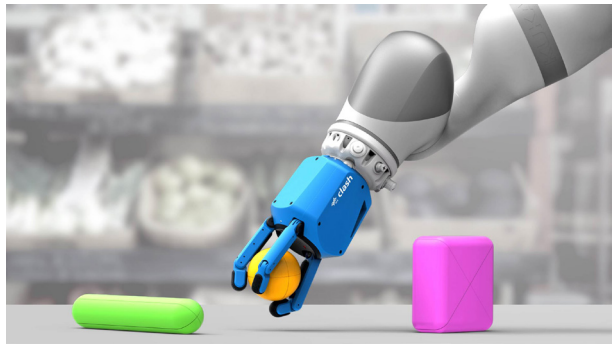
SOMA (Soft Manipulation) opens a path of disruptive innovation for the development of simple, compliant, yet strong, robust, and easy-to-program manipulation systems. The main obstacle to a wide-spread adoption of advanced manipulation systems in industry is their complexity, fragility, lack of strength, and difficulty of use.

The SOMA project explores a new avenue of robotic manipulation in real environments, exploiting the physical constraints imposed by the environment combined with an inherent flexibility of the manipulator to enable robust grasping and manipulation in dynamic, open, and highly variable contexts.

New Soft Hands are designed and novel mechatronic, control, and planning concepts are tested for the versatile and competent exploitation of environmental constraints, and the development of robust, cost-effective, and safe robotic grasping and manipulation capabilities.



The RBO hand developed by the partner TU Berlin.



The ***DLR CLASH Hand*** is designed for safe and reliable grasping of groceries.

Applying SOMA techniques to the real world

The DLR SOMA demonstration showcases the results of the developments achieved at DLR for a use case of commercial food handling. It shows capabilities of the ***DLR CLASH Hand***, which is a compliant, yet low-cost hand for safe and reliable grasping of groceries. A vision system is used to sense the position and orientation of the object, while a DLR light-weight robot carries the hand and object.

The fingers of the hand can further adapt their compliance by an additional motor according to the gripped object. For example, when grasping a mango, the fingers can be made soft in the pre-shaping face in order to increase the number of contact points for a stable grasp but keeping grip forces low. In order to lift the heavy mango afterwards without losing it, the fingers can increase their stiffness without increasing the applied forces. This mechanism is inspired by human hands, where cocontraction of antagonistic pairs of muscles leads to an increase of hand stiffness. The result is a stable and reliable grasp without damaging the gripped object.

The hand is further equipped with several sensors, such as tactile sensors at the palm and force and position sensors in the fingers. Another distance sensor in the palm can measure the distance to an object.

SOMA: Interacting with Soft Hands

The key ingredient for the exploitation of the Environmental Constraints is softness of hands, i.e. their embodied ability to comply and adapt to features of the environment.

The traditional paradigm for robotic manipulation is in complete disarray in front of this shift of focus: state-of-the-art grasp planners are targeted towards rigid hands and objects, and attempt to find algorithmic solutions to inherently complex, often ill-posed problems.

Further complicating matters, the requirement of planning for soft, uncertain interactions between hand and environment is entirely beyond the state of the art. However, this is how humans most often use their hands, and how we plan to change robotic manipulation.

SOMA will apply the results of the project as test cases to an open manipulation problem in the food and agriculture industry: How to handle irregularly shaped, flexible, and easily damageable goods, such as fruit and vegetables.

Another application will involve a security problem in a field such as entertainment, where physical interaction between human and robots would add a considerable amount of value to the experience in terms of fun.

The Softhand developed by the partners University Pisa and IIT.