Robots with a soft touch

Robots that will daily operate in human environments, will need a 'soft touch'. The robots we know from industrial production, are extremely precise and fast, but very rigid as well. For physical and safe contact with people, or for handling vulnerable food products, they don't perform well. '4TU Soft Robotics' chooses a nature-inspired approach: the grip of a tree frog and the flexible arm of a cuttlefish. For this, knowledge of biology, fully new control systems and innovative robot design strategies go hand in hand. The partners of the technical universities strengthen each other in this. This can make The Netherlands leading in this young field of research and technology.

The robots we all know from industrial production, like car assembly, are capable of performing their preprogrammed tasks with a high level of precision, force and speed. Although they have some 'joints' for increasing their freedom of movement, the robot arms are basically very stiff and rigid. For safety reasons, human beings should keep their distance when the robots are operational. But what does this imply for robots that we will encounter in our daily life? 'Soft robotics' is a new area, in which researchers are inspired by nature. It should lead to robots operating in a reliable and safe way, interacting with people in cure, care and rehabilitation, for example. It will also lead to robots that can deal with delicate organic matter: they have to be able to pick up a ripe strawberry.

For this, the idea of rigid robotic arms will be left behind. What if we take the tentacle of a cuttlefish as a source of inspiration, combined with the gripping system of a tree frog? This would be a radically different approach: the arm of a cuttlefish has many degrees of freedom and its nervous system is distributed across the whole arm.

In order to translate these features to a robotic arm, knowledge of biology is needed, of advanced control systems and of new types of sensors and actuators. It combines the knowledge of biomechanics and 'bio-inspired adhesion' (Wageningen), nonlinear control systems (Eindhoven), man-machine interaction (Delft) and biomechatronics (Twente). For creating prototypes, 3D printing techniques are added.

This will ultimately result in robots that interact with us in a natural way. For this, the researchers will cooperate with partners in industry, agro-tech and health care. An example is a robotic suit for rehabilitation purposes: instead of a rigid exoskeleton with heavy metal joints and parts, a flexible suit will be developed with a soft touch. It will also result in surgical robots that can handle soft tissue better. Human-robot interaction, as a whole, will get more intuitive, the partners expect. In food and agro, with vulnerable products of very different sizes and levels of ripeness, the robots will play an important role as well.

By combining unexpected fields of research, a fully new approach will be possible. The programme has the potential of making The Netherlands leading in the new field of soft robotics, according to programme leader Prof Herman van der Kooij (UT/TUD).