

SoftHand Pro

“Simplicity is a great virtue but it takes hard work to achieve it. As well as education to appreciate it. And to make matters worse, complexity sells better.”

EDSGER W. DIJKSTRA



EXCELLENT SYNERGIES AROUND SOFTHANDPRO



SOFT ROBOTICS FOR HUMAN
COOPERATION AND REHABILITATION

Research & Development European Institute-
SoftHand Pro Developers
www.softbots.iit.it

Italian Industrial Robotic Field –
SoftHand Pro Manufacturer
www.qbrobotics.com



Prosthetic Center- Cosmetic prosthesis-
SoftHand Pro applicator
www.procosil.com

qbrobotics



Around the new robotic hand **SoftHand Pro** the collaboration between the **Softbots Italian Institute of Technology**, a foundation that carries out scientific research activities of public interest for the purposes of technological development and scientific innovation, **QbRobotics**, an Italian research and development company active in the field of industrial robotics and manufacturer of innovative devices that implement the **soft robotics technology**, capable of ensuring high reliability of the production process and **Procosil** present in the prosthetic field for almost **30 years** internationally.

An exceptional combination that guarantees **innovation**, **reliability** and **competence** in the prosthetic sector.



- Rehabilitation
- Rehabilitation engineering is the use of engineering principles to 1) create methods, technologies and devices to assist individuals with disabilities and 2) contribute to the recovery of physical and cognitive functions lost because of a disease or an injury. Our lab's experience in this topic includes the development of the SoftHand Pro, a robotic hand for prosthetic applications **supported by European H2020 and ERC projects**. Our work on prosthetics is currently funded by the "[Natural Bionics](#)" ERC Synergy project (2019-2025). **Natural Bionics is an international collaboration of European researchers** with the aim of creating fully integrated, symbiotic replacements for human limbs. This collaboration involves three main groups with multidisciplinary backgrounds that combine bioengineering, surgery and soft robotics expertise.
- Upper-limb prostheses
- Although prostheses allow the recovery of part of the functions lost after an amputation, the human-machine interface and the mechanical features of robotic devices could limit the performance and development of arms prostheses. The Softbots Lab investigates systems designed and controlled through the concept of **soft synergies**. This method combines the implementation of simple motor functions, inspired by **human arm synergies**, with under-actuated systems and soft joints to adapt the system properties and motion to the task requirements and multiple object shapes. We aim at proposing functional and dexterous devices that can still be controlled with **few and natural signals from the user**. In addition, other key aspects such as sensory feedback are explored in this section to contribute to the full experience of prosthesis users. We have participated in many Cybathlon series, which are events that test and compares rehabilitation technologies in challenging situations.

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 - Procedimento di interazione con oggetti, A. Bicchi, G. Lentini, M.G. Catalano, G. Grioli, Application Number 102021000003821 (2021-19-02) [Submitted]
- 2020
 - Piede Robotico Adattivo in combinazione con caviglia passiva, M. Hutter, R. Persichini, F. Bonomo, G. Valsecchi, M.G. Catalano, G. Grioli, C. Petrocelli, M.J. Pollayil, M. Garabini, A. Bicchi, Application Number 102020000024727 (2020-20-10) [Submitted]
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- Development of Robotic Hands
- *PISA-IIT SoftHand*: One of the motivations behind the development of humanoid robots is the will to comply with, and fruitfully integrate in the human environment, a world forged by humans for humans, where the importance of the hand shape dominates prominently.
PISA-IIT SoftHand implements the concept of adaptive synergies for actuation with an high degree of integration, in a humanoid shape.

- The **Pisa/IIT SoftHand** is simple, robust and effective in grasping.
- Simple because only one motor actuates the whole hand;
Robust because suitable joint design allows for disarticulation;
Effective thanks to the soft-synergy idea applied to 19 degrees of freedom
- The idea at the core of the Pisa/IIT SoftHand, i.e. soft synergies, comes from the combination of natural motor control principles. As a result the hand pose is not predetermined, but depends on the physical interaction of its body with the environment, allowing to grasp a great variety of objects despite its single degree of actuation.

Simplicity, robustness, lightness and effectiveness make the Pisa/IIT SoftHand ideal for both humanoid robotics and prosthetics.
- the recent improvement, **Pisa/IIT SoftHand PLUS**, is actuated by two motors for to perform not only grasping, but also complex manipulations on objects.
- **Winner of the Best paper Award at Humanoids 2012:** "Adaptive Synergies for a Humanoid Hand", M. G. Catalano G.Grioli A. Serio E. Farnioli C. Piazza A. Bicchi
- **Best Poster Award @EuroHaptics 2014:** "A change in the fingertip contact area induces an illusory displacement of the finger", Alessandro Moscatelli, Matteo Bianchi, Alessandro Serio, Omar Al Atassi, Simone Fani, Alexander Terekhov, Vincent Hayward, Marc Ernst and Antonio Bicchi.
- **Best Interactive paper award at Humanoids 2015** "Dexterity augmentation on a synergistic hand: the Pisa/IIT SoftHand+", C. Della Santina, G. Grioli, M. Catalano, A. Brando, A. Bicchi .
- [UNIPi team Finalist at the Amazon Picking Challenge](#)





- **qbrobotics** is an Italian company founded in 2011 as a research and development company active in the robotics field as producer of innovative devices implementing the *soft-robotics* technology such as robotic hands, grippers for robots and cobots, handles, Robot KIT and VSA actuators.
- The company is based in Tuscany in the [Robotics and Technology Cluster of Pisa \(Polo Tecnologico di Navacchio\)](#) and thanks to its international distribution network is able to operate internationally.
- The organization structure evolved fast during the last three years, reaching 10 employees in 2020: the entire team can boast a high-level CV and top background in their field with solid primary background in robotics: from the technical and R&D side, all people are coming from the [IIT – Italian Institute of Technology](#) and from the [University of Pisa \(Research Center “E. Piaggio”\)](#) of which **qbrobotics** is a spin-off.
- Each business process is implemented internally: from research, development and testing to hardware design and software programming to the production and assembly process.
- The constant search for innovation in the field of robotics and automation has led **qbrobotics** to internalize all the production processes and to create its own robotics laboratory – **qblab** – where the testing phase is carried out and where the new product lines are developed.

The company has now four different research business units that are divided considering the peculiarity of the destination

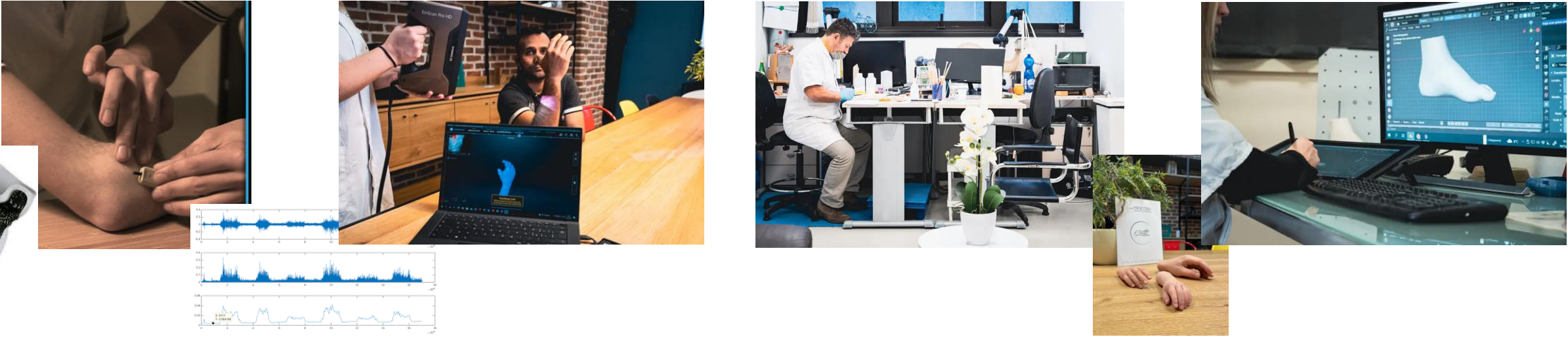
- **qbrobotics** is producing an anthropomorphic artificial hand that is used for prosthetic and rehabilitation activities by research institutes.
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- **qbrobotics** is a provider of robot hands to private companies and robotics laboratories producing and commercializing humanoid robots.
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- In this field, **qbrobotics** provides two products (the modular actuator VSA and a robotic hand – qb SoftHand Research) to research institutes, universities, schools and R&D departments of private and public companies.
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- **qbrobotics** started a fourth industrial business unit at the beginning of 2018 to propose industrialized versions of the [qb SoftHand](#) to users that currently employ collaborative robots in their production and testing lines.
- **qbrobotics** has grown to successfully consolidate its position in the *soft-robotics* field and the company can boast collaborations with: multinational companies in the field of robotics, collaborative robotics and industrial automation, biomedical research institutes, universities and robotics departments worldwide.



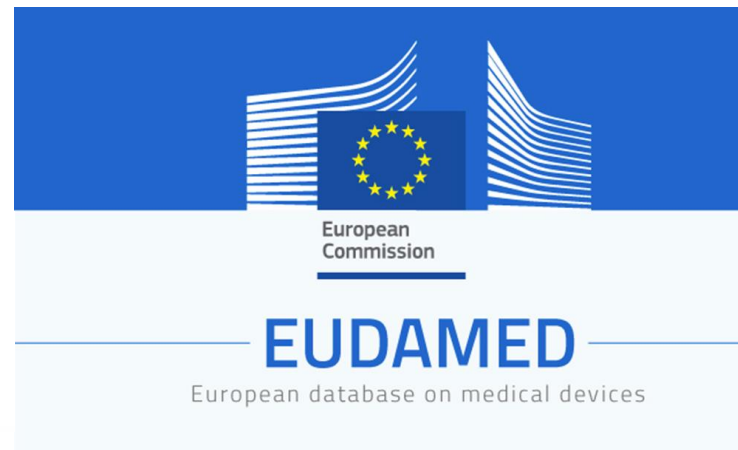
- We have been using an original system for making silicone prostheses since **1996**. The Procasil center specializes in the creation of **silicone cosmetic prostheses** for the upper, lower limbs and maxillofacial.
- In these almost **30 years of presence** in the prosthetic field we have achieved and implemented a unique and incomparable technology, but we are always on the constant search for **new materials and technologies** and willing to implement new techniques.
- We have established our roots in **San Marino**, one of the oldest republics in the world located within the Italian territory, expanding our market more and more until today we collaborate with a large part of the **world**.
- In fact, our goal is to create **work synergies** by relying on selected partners in the orthopedic sector. Thanks to these consolidated collaborations and cutting-edge technology, it is possible for us to work remotely through training courses given directly to our future collaborators or, if this is not possible, through the organization of trips for our **specialized technicians**.
- This therefore allows for further care for the patient, who in this way will not be forced to travel, but thanks to our **wide network of contacts**, he will be able to refer to the nearest center.
- Distance, therefore, in no way interferes with the level of **customization** that we are able to provide to our prostheses and in no way penalizes the patient in the care and support that we will provide, in this case, through our trusted partners.
- Our staff consists of:
 - Biomedical engineer . Psychologist . Cad/Cam technician
 - Orthotic & Prosthetic Technician . Specialist colorist
 - Mechanical expert . Dental technician
 - Corporate Lawyer



SERVICES AROUND THE PATIENT

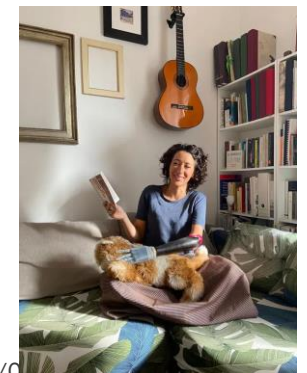


- Thanks to our high specialized technical staff, Procasil provides all services around the patient from imprint to delivery.
- 1- our specialist cad/cam technician takes 3d scan imprint. To elaborate the prosthetic shape through software 3d modelling.
- 2- our Orthotic & Prosthetic Technician, specialized in the upper limb bionic solution, takes care of all technical steps on site, from EMG signals research, test socket with electrodes, training... to the delivery.
- 3- our specialist color technician reproduces the skin pigmentation of the patient on site for a better result and taking care of the needs of the patients.



- **QUALITY PROCESSES**
- **Certifications**
- We guarantee a management system to protect the end customer and his **satisfaction**, through the planning, monitoring and continuous improvement of the operational and support processes, designing and implementing the quality management system as a means to achieve the objectives, according to the **UNI EN ISO 9001:2015** standard.
- We are equally compliant with **EU Regulation 2017/745 MDR** relating to medical devices.
- PROCOSIL is registered at French **ANSM** (National Agency of Medicine Security and Medical Devices) and more important to respect the last **European Regulation 2017/745 MDR**, also registered at **EUDAMED** (European Database on Medical Devices) and allow us to issue **CE DECLARATION OF CONFORMITY** for our products.
- Our raw materials are chosen with care: in fact these last have passed biocompatibility and cytotoxicity tests, according with the **UNI EN ISO 9001:2015** and **ISO 10993-5** standards.

- The **Pisa/IIT SoftHand** is a simple, robust and effective hand designed for grasping and soft manipulation. Simple because only one motor actuates the whole hand. Robust because innovative, biomorphic joint design allows perfect recovering after large deformations and even disarticulation. Effective thanks to the soft-synergy idea applied to 19 degrees of freedom. The idea at the core of the Pisa/IIT SoftHand, i.e. soft synergies, comes from the combination of natural motor control principles. As a result the hand pose is not predetermined, but depends on the physical interaction of its body with the environment, allowing to grasp a great variety of objects despite its single degree of actuation. The Pisa/IIT SoftHand is an open hardware project under the umbrella of the Natural Machine Motion Initiative. A commercial version of the hand, the qbhand, is produced by a spinoff of Centro Piaggio and IIT, qbrobotics srl, intended for industrial applications.
- **SoftHandPro** is the prosthetic version of the **Pisa/IIT SoftHand**, developed thanks to SoftPro, a H2020 research project. Thirty prosthetic users are currently testing it in 4 academic and rehabilitation centers around the world, to improve design, dexterity, and fitness to myoelectric prosthetic use.



PRODUCT

■ Overview

- The Pisa/IIT SoftHand Pro is an anthropomorphic robotic hand which has evolved from the Pisa/IIT SoftHand.
- Pisa/IIT SoftHand 2 has 19 joints. Five of them are simple revolute joints, and they implement the adduction/abduction movement of each finger. The remaining 14 joints are compliant rolling-contact element (CORE) joints
- A single tendon moves from the palm base, through all the fingers. Two motors actuate the tendon, pulling it from its two sides. If the motors move in the same direction, the tendon length is shortened, and the SoftHand 2 closes. If instead the two motors move in opposition, the tendon slides, and the hand moves according to the friction-driven DoA.
- The hand includes two MAXON DC-X 22 s 24 V motors, mounted on the back. We also included 86:1 gearboxes, characterized by 15 W of continuous output power. A single Dyneema tendon runs in the whole hand. The motor positions are acquired using magnetic sensors from Austrian Microsystems. Two encoders are included for each motor. The firmware is implemented on a custom electronic board, mounted on the bottom part of the hand.
- The geometry of the hand's bottom part is designed to guarantee an easy connection with standard mechanical interfaces. Thanks to the proposed actuation principle, combined with the mechanical design, SoftHand 2 is completely self-contained. Motors, electronics, and sensors are all on-board, and only the energy supply is external to the hand. This design allows the easy plug-and-play integration of the SoftHand 2 with robotic manipulators.
- A commercial version of the hand, the [qbhand](#), is produced by a spinoff of Centro Piaggio and IIT, [qbrobotics srl](#).