Introduction

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Soft Robotics is now considered one of the most promising frontiers for robotics research and technological innovation. The enormous growth of this field in the last few years has been evidenced by a large increase in the number of publications, special issues in journals, focused sessions and workshops at international conferences, summer schools, competitions, EU funded projects, as well as new laboratories, companies and faculty appointments.

Being "soft" is more and more a characteristics needed in robotics systems, especially in those that have to interact with humans or within particular environments. The importance of soft body parts appears clear if taking a look at many natural organisms, where softness, compliance, and embodied intelligence are useful characteristics for reducing the complexity of behaviour control [1]. The vast majority of natural organisms are soft-bodied indeed, and even those with stiff skeletons are predominantly made of soft materials. Caterpillars, octopuses, manta-ray, some fishes and snakes, birds, plants, and others, have therefore inspired engineers for the design and development of new soft technologies and soft systems, as well as for implementing new strategies for terrestrial and underwater locomotion or flying (examples can be found in [2–10]).

The field of soft robotics is highly multi-disciplinary, linking know-how from material science, mechanical/electrical engineering, control engineering, chemistry, physics, computer science, biology and many more.

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There are several cases where soft technologies and integrated soft systems could revolutionize the use of robotic devices, especially in applications where elastic versatility and safe human-robot interaction are needed.

Industrial robotic arms, agriculture robots, surgical robots, robots for search and rescue, wearable systems, exoskeletons and rehabilitation devices can benefit from the use of soft and variable-stiffness components to increase their capacities to interact safely, dependably and effectively with humans and the physical environment.

Soft robotics has the potential for allowing the development of a radically new generation of machines with better performance in the real world, and greater adaptability in a variety of tasks [11].

The interdisciplinary characteristics of soft robotics, the high number of research laboratories in Europe and worldwide that are working in its various subfields (smart materials, biomimetics, embodied intelligence, etc.) and the more recent interest of industrial stakeholders, have arisen the necessity for the creation of a common forum to help researchers to combine their efforts and to maximize the opportunities and materialize the potential impact of soft robotics.

Following this need, RoboSoft, the EU-funded FET-Open Coordination Action (CA) for Soft Robotics (http://www.robosoftca.eu/), started on October 1, 2013 to pose the basis for consolidating the soft robotics community and for enabling the accumulation and sharing of crucial knowledge needed for scientific and technological progress in this field.

RoboSoft has been running for 3 years coordinated by The BioRobotics Institute of the Scuola Superiore Sant'Anna (Italy) in partnership with the ETH Zurich (Switzerland), the University of Cambridge (UK), and the University of Bristol (UK) and it has organized a series of scientific and technical events and activities to unify and extend the community of soft roboticists, to educate a young scientific community of students, to promote the visibility of soft robotics towards stakeholders and special interest research groups and to provide opportunities for better exploiting the potential of soft robots and technologies in future ICT.

Research laboratories and institutions at European and international level working in the field of Soft Robotics have been involved and supported for taking part in the scientific initiatives of the Coordination Action as Members of the RoboSoft Community.

Their representatives are experts in various scientific and technological areas related to soft robotics (smart materials, soft actuators and sensors, control architectures, energy storage, harvesting soft devices, stretchable electronics, biology) and during the periodic meetings they participated in consultations aimed at discussing new challenges, milestones, to redefine theories and techniques, and to provide research roadmaps within a single coherent vision for soft robotics.

RoboSoft has created a large network of scientists and industries and has established strong collaborations with other initiatives worldwide that are dedicated to the promotion of soft robotics, such as the IEEE Robotics and Automation Society (RAS) Technical Committee on Soft Robotics, or education-related initiatives, such as the Soft Material Robotics IGERT at Tufts University and the Marie Sklodowska-Curie Initial Training Network SMART-E.

RoboSoft is now a pillar for the community of soft robotics because of the several events and initiatives organized for merging people, for helping the scientific discussion and for promoting soft robots.

The main events organized by RoboSoft were the annual Plenary Meetings for Community Members, the Schools for Ph.D. students, a series of workshops, special sessions and exhibitions at major robotics conferences, a number of dedicated academia-industry meetings and other initiatives for cross-fertilization with other scientific communities.

The flagship event dedicated to the soft robotics community was launched by RoboSoft in 2015 and named the "Soft Robotics Week", a week totally dedicated to Soft Robotics, featuring a unique concentration of several scientific, cultural and educational events.

International experts across multiple fields in the scientific community of soft robotics, industrial leaders, young researchers and students, met together to present current research and technologies of soft robotics, discuss the challenges and expected milestones, provide research roadmaps and identify the needed supporting actions for this field.

This book represents the proceedings of the second edition of Soft Robotics Week, held in Livorno from April 25 to 30 2016 and presents the current state of soft robotics, collecting the major research lines and novel technologies and approaches presented and discussed during the event by the RoboSoft Community.

The main themes are related to soft robot legged locomotion, soft robot manipulation, underwater soft robotics, biomimetic soft robotic platforms, plant-inspired soft robots, flying soft robots, soft robotics in surgery, as well as methods for their modelling and control.

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