Editorial

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Wearable robotics for a sustainable society

Countries all over the world are facing several industrial automation challenges in helping operators perform more efficiently while ensuring the safety, health and sustainability of their workforce. Among which, there are two important and interrelated topics that will universally affect manufacturing as we know it. First, the number of people aged 60 years or over on a global level is projected to grow by 56% between 2015 and 2030 according to the United Nations and could double in size by 2050. At the same time, Industry 4.0 is seeing processes and people become increasingly interconnected. This new manufacturing paradigm necessitates full cooperation between workers, advanced robotics and the added-value digital technologies around them. HUMANufacturing, as we call it at Comau, puts humans at the center of the smart factory together with safe industrial and collaborative robots, logistics systems and easy-to-use digital solutions. This paradigm goes in line with Robotics future challenges that are: Simplification, Digitalization, Collaboration.

Enabling technologies such as Comau AURA (Advanced Use Robotic Arm), which can potentially transform any standard industrial robot into a collaborative robot, and Comau Agile1500 automated mobile robot, among others, are paving the way to better manufacturing. Indeed, the strategic dialogue in Europe between academia and industry, is actively pursuing ways to leverage the benefits of human-robot collaboration inside and outside the new smart factory.[1]

In 2013, the McKinsey Global Institute[2] identified *twelve disruptive technologies* that were expected to transform societies, among which, *advanced robotic systems and robotic exoskeletons.* The later of the two provides robotics-enhanced movement assistance that can help facilitate a healthier and less-restricted life for the elderly as well as people with movement disabilities. In this scenario, exoskeletons are seen as a disruptive technology that will improve the life of the next generation by supporting and assisting people in their daily activities, at work or during leisure activities.

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1 European Commission and SPARC's H2020 Strategic Research Agenda for Robotics

2 Disruptive technologies: Advances that will transform life, business, and the global economy", McKinsey Global Institute, 2013.

In 2017, the EU Commission promoted a COST[3] action regarding Wearable Robots for Augmentation, Assistance or Substitution of Human Motor Functions[4] with the goal of connecting experts and contributing to the development of novel wearable robots for different application domains. A similar objective is being pursued in the United States by the US National Robotics Initiative. Looking closer at the global demand for wearable robotics and industrial exoskeletons, WinterGreen Research[5] has valued the market at US$36.5 million in 2015 with projected growth reaching US$2.1 billion by 2021. Much of this revenue will likely be generated by medical exoskeletons. However, an increasing number of companies are designing systems for other industries and the world is seeing wearable robotics for the workplace becoming one of the most promising new application domains.

Assisting humans as they perform repetitive tasks is a reasonable solution for increasing productivity while improving quality and protecting human subjects from performing strenuous repetitive movements. It also delivers the added benefit of reducing work-related musculoskeletal diseases. Yet active exoskeleton prototypes, despite their potential, have not fully reached the market yet. This is due in part to their complexity, which creates challenges in terms of device acceptability, compliance with safety regulations and cost effectiveness. Several passive and spring-based exoskeletons have now been developed to support workers during manual and repetitive tasks including overhead manipulation, lifting and moving objects, using heavy tools and bending/squatting. A handful of companies including Comau, with its MATE[6] exoskeleton, offer ergonomic systems designed for workers in different industrial sectors. By reducing physical fatigue and improving ergonomics, MATE can improve the quality of work while delivering lightweight, breathable and effective postural support.

Passive exoskeleton devices can vary greatly in terms of their size, weight and characteristics, but each of them promises to reduce the users' workload, mitigate the risk of work-related injuries and improve overall productivity. Furthermore, their minor complexity, given that they are not externally powered, allow them to be easily deployed in numerous manufacturing environments ranging from automotive and energy to different general industry sectors. As a result, over the next few years we can expect to see passive exoskeletons promoting the establishment of a new era: the era of wearable robotics.

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3 COST (European Cooperation in Science and Technology)

4 www.wearablerobots.eu

5 "Wearable Robots, Industrial Exoskeletons: Market Shares, Market Strategies, and Market Forecasts, 2016 to 2021", WinterGreen Research, 2016.

6 Developed by Comau in collaboration with IUVO and ÖSSUR; commercialized by Comau.