

Humans and Robots Working Together

By Bram Vanderborght

The market for classic industrial robots is still growing, with China, in particular, breaking records in robotization and automation. Moreover, the need to improve flexibility for agile and more customized production as well as changing workplace demographics is spurring research toward collaborative robots (cobots).

Additional research is needed to remove the remaining technological barriers and achieve optimal human-robot collaboration as well as provide best practices.

for humans. This suggests that more small- and medium-sized companies will seek to adopt robotics technology. Traditional industrial robots have not only material but also programming and installations costs, consequently

making them expensive; the aim for cobots is to keep the price reduced.

Research conducted over the past decade has helped create a new generation of safe, often torque-controlled manipulator arms as opposed to classic position-controlled robots. Several existing robotics companies and an increasing number of startups are offering this new generation of robots, which no longer need to be kept in cages for safety reasons, as has been the case with many current industrial manipulators. Although these new applications are still in the early stages of development, the market is expected to grow to US\$4.28 billion by 2023 and progress at a compound annual growth rate of 56.94% between 2017 and 2023. Still, numerous industrial cobots in protective cages continue to be used strictly for automated jobs. Additional research is needed to remove the remaining technological barriers and achieve optimal human-robot collaboration as well as provide best practices.

Therefore, we think this special issue on human-robot collaboration for production environments will help disseminate those best practices and provide direction for further research and industrial implementation. Accordingly, I would like to thank guest editors Andrea M. Zanchettin from Politecnico



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Two upcoming special issues of *IEEE Robotics and Automation Magazine* will target applications that are too dangerous for human workers. The first is the December 2018 issue on floating-base (aerial and underwater) manipulation. A large number of applications are being investigated in which underwater and aerial robots exceed their monitoring and surveillance capabilities; their potential to accurately manipulate objects will make possible a whole new set of applications.

In March 2019, we will publish a special issue focusing on robots for in situ interventions. Topics include the versatile performance of holistic post-production operations (e.g., inspection, maintenance, and repair) in a (nearly) real industrial setting for complex installations (e.g., nuclear power plants or offshore oil and gas platforms), highly engineered products (e.g., aero-engines), or civil engineering assets (e.g., bridges). But first enjoy this issue!