BORSA N. 25

DAUSY

D.M. 352/2022

Co-finanziata da: ICAM S.r.l.
Tematica: “Decision and control techniques for collaborative robotics in automated warehouses”

Research theme title:

Decision and control techniques for collaborative robotics in automated warehouses

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Curriculum of DAUSY:

C1 AS for Automation

Hosting University/Research Centre

Polytechnic of Bari, Italy

Department:

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Prospective Supervisors:

Prof. Mariagrazia Dotoli (http://dclab.poliba.it/people/mariagrazia-dotoli/)

Dr. Raffaele Carli (http://dclab.poliba.it/people/raffaele-carli/)

Description:

The Fourth Industrial Revolution, also known as Industry 4.0, is reshaping the way individuals live and work while providing a substantial influence on the manufacturing scenario. One of the key enabling technologies that has made Industry 4.0 a concrete reality is without doubt collaborative robotics, which is also evolving as a fundamental pillar of the next revolution, the so-called Industry 5.0 that reinserts proactively humans back into the automation chain, allowing operators and robots to work significantly more closely together. In contrast to robots that predominantly work independently from humans and often reside in a cage, collaborative robots (cobots) co-exist in the same environment together with humans, without renouncing to safety or efficiency.

The goal of this project is to develop innovative decision and control techniques for human robot collaboration (HRC) by ensuring the best trade-off between safety and ergonomics for the operator and efficiency for the industrial process. In particular, this project will focus on the automation of production processes in the context of internal logistics and therefore in industrial warehouses, not yet fully automated, in which there are significant margins for developing innovative solutions aimed at increasing productivity and profitability, with the simplification, planning, and scheduling of robot and operator activities in accordance with safety and ergonomics requirements.

The research will be applied to real logistic scenarios provided by ICAM Srl, which is an Italian company specialized in automated solutions for automated warehousing and Logistics 4.0.

Specific Information:

Applicants must hold a master's degree, preferably in Engineering, with a good background in relevant areas of interest (i.e., robotics, optimization, and control). Solid mathematical and coding skills are encouraged. Proficiency in both spoken and written English is required. The candidate should be highly motivated and interested in undertaking innovative and challenging research activities involving both theoretical analysis and experimental validation, in strong connection with an Italian logistic company, which will be the final user of the applications. Technical and soft skills are strongly required to meet, during the research, a continuous trade-off between industrial needs and research challenges.

References:

[1]. Proia, S., Carli, R., Cavone, G., & Dotoli, M. (2021). Control Techniques for Safe, Ergonomic, and Efficient Human-Robot Collaboration in the Digital Industry: A Survey. IEEE Transactions on Automation Science and Engineering.
[2]. Proia, S., Cavone, G., Carli, R., & Dotoli, M. (2022). A Trajectory Planning Optimization Approach for a Safe and Ergonomic Human-Robot Collaboration In 2021 IEEE 18th International Conference on Automation Science and Engineering (CASE). IEEE.
[3]. Cherubini, A., Passama, R., Crosnier, A., Lasnier, A., & Fraisse, P. (2016). Collaborative manufacturing with physical human–robot interaction. Robotics and Computer-Integrated Manufacturing, 40, 1-13.
[4]. Zanchettin, A. M., Ceriani, N. M., Rocco, P., Ding, H., & Matthias, B. (2015). Safety in human-robot collaborative manufacturing environments: Metrics and control. IEEE Transactions on Automation Science and Engineering, 13(2), 882-893.
[5]. Lucci, N., Lacevic, B., Zanchettin, A. M., & Rocco, P. (2020). Combining speed and separation monitoring with power and force limiting for safe collaborative robotics applications. IEEE Robotics and Automation Letters, 5(4), 6121-6128.

[6]. Ferraguti, F., Villa, R., Landi, C. T., Zanchettin, A. M., Rocco, P., & Secchi, C. (2020). A unified architecture for physical and ergonomic human–robot collaboration. Robotica, 38(4), 669-683.

Type of scholarship:

DM 352/2022 – Industrial Project

Study and research period outside the Hosting Institution:

9. Study and research period at the company:
- period length: 12 months;
- Company:
  - ICAM srl, S.P. 237 delle Grotte, Putignano BA 70017 Italy (https://www.icamonline.eu/en/)

10. Study and research period abroad:
- period length: 6 months;
- Hosting institution:
  - Rutgers, The State University of New Jersey, Department of Mechanical & Aerospace Engineering, 98 Brett Road, Piscataway, NJ 08854 – USA (https://mae.rutgers.edu/jingang-yi - https://mae.rutgers.edu/)