BORSA N. 35

DAUSY

D.M. 352/2022

Co-finanziata da: SCHNELL S.p.a.
Tematica: “Self-diagnosis and total fault prediction solutions based on data and signals in autonomous machines for structural steel processing”

Research theme title:

Self-diagnosis and total fault prediction solutions based on data and signals in autonomous machines for structural steel processing

Contacts:

Prof. Longhi Sauro

e-mail: sauro.longhi@univpm.it

Curriculum of DAUSY:

C1 AS for Automation

Hosting University/Research Centre

Università Politecnica delle Marche, Italy

(Marche Polytechnic University, Italy)

Department:

Dipartimento di Ingegneria dell’Informazione - DII

(Department of Information Engineering – DII)

Via Brecce Bianche, 12, 60131, Ancona, Italy

https://www.dii.univpm.it/

Prospective Supervisors:

Prof. Longhi Sauro (sauro.longhi@univpm.it)

Description:

In the context of Industry 4.0 the need for even more intelligent production systems organised as cyber-physical production systems (CPPSs) is increasing the focus on Predictive Maintenance (PdM) strategies to increase the utilization rate (availability) of production equipment and decrease the cost of downtime. By affecting equipment availability, PdM have a direct impact on the overall effectiveness of both equipment and throughput, generating both cost and time savings. The aims are to establish an intelligent, interoperable, and autonomous production environment. The problem of self-diagnosis and total fault prediction solutions is receiving enormous interest for an efficient and reconfigurable manufacturing environment. Collaborative robots or automatic devices for handling the tools change or to feed the automatic machineries without human intervention in an automated shopfloor of smart factories is indeed a significant challenge for the real-time control and management aimed at predicting and preventing downtime while ensuring an increase in machines availability, productivity, and production flexibility. The objective of this project is to estimate the wear of the automatic machineries, mainly in their critical components such as tools, motor operated devices, actuators, mechanical or electrical devices, etc. in order to go towards self-diagnosis and total fault prediction of these machines. Further investigations and results should relate to solutions to predict production and machines needs without human intervention. For the purposes of predictive maintenance, algorithms and solutions must be studied in a broad spectrum considering multiple approaches, such as signal-based, data-driven, machine learning and so on, the solutions must be focused on forecasting the residual useful life of the devices. analyzed and of the machinery in a more general sense.

Specific Information:

Applicants must hold a master's degree, preferably in Engineering. A good background in relevant areas of interest (i.e., machine learning, optimization, and control) is desirable. 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 company market leader in the production of automatic machinery for construction sector, 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]. Bonci, A. Di Biase, A. F. Dragoni, S. Longhi, P. Sernani, A. Zega, "Machine learning for monitoring and predictive maintenance of cutting tool wear for clean-cut machining machines" 27th IEEE International Conference on Emerging Technologies and Factory Automation (ETFA22), Stuttgart, Germany, Sept 6-9, 2022 (under publication).
[2]. Bonci S. Longhi, G. Nabissi, F. Verdini, "Predictive Maintenance System using motor current signal analysis for Industrial Robot" 24th IEEE International Conference on Emerging Technologies and Factory Automation (ETFA19), Zaragoza, Spain, Sept 10-13, 2019, pp. 1453-1456

[3]. Bonci, S. Longhi, G. Nabissi, "Fault Diagnosis in a belt-drive system under non-stationary conditions. An industrial case study" Proceedings - 2021 IEEE Workshop on Electrical Machines Design, Control and Diagnosis, WEMDCD 2021, pp. 260-265.
[4]. Bonci, Pangcheng David Cen Cheng, M. Indri, G. Nabissi and F. Sibona. "Human-Robot Perception in Industrial Environments: A Survey", Sensors MDPI, Vol. 21, Issue 5, pp. 1-29, Feb. 24, 2021.
[5]. Bonci, D. Stadnicka, S. Longhi, "The Overall Labour Effectiveness to Improve Competitiveness and Productivity in Human-Centered Manufacturing", Lecture Notes in Mechanical Engineering, pp. 144-155, 2022.
[6]. Bonci, S. Longhi, G. Nabissi and G. A. Scala. "Execution Time of Optimal Controls in Hard Real Time, a Minimal Execution Time Solution for Nonlinear SDRE", IEEE Access, Vol. 8, Issue 1, pp. 158008-158025, Aug. 27, 2020.

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: 6-12 months;
- Company:
  - SCHNELL SpA, Via Sandro Rupoli, 2 – Colli al Metauro (PU) Italy https://www.schnellgroup.com/en/

10. Study and research period abroad:
- period length: 6 months;
- Hosting institution:
  - Maynooth University - Department of Electronic Engineering, Maynooth, Co. Kildare, Ireland
  - https://www.maynoothuniversity.ie/electronic-engineering

https://coer.maynoothuniversity.ie
http://www.eeng.nuim.ie/jringwood/