

RESEARCH TOPIC FOR THE PARISTECH/CSC PHD PROGRAM

Field: *Design, Industrialization*

Subfield: Industrial Engineering

Title: Ergonomic and Cognitive Decision Support System to manage daily a Reconfigurable Manufacturing System with Collaborative Robotics

ParisTech School: Arts et Métiers Sciences et Technologies

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Research group/Lab: LCFC, LISPEN

Lab location: Metz, Lille

(Lab/Advisor website): <http://lfcf.ensam.eu/> ; <https://lispen.ensam.eu/>

Short description of possible research topics for a PhD:

In the current Industry 4.0, mass customization revolutionized production and assembly systems. Reconfigurable Manufacturing Systems (RMS) tend to be the new norm. At a strategical level, previous works helped the manager to design such systems, and to invest in new resources. Mobile and collaborative robotics are resources that allow the production system to reconfigure itself quickly. The aim of the proposed PhD is to focus at the operational level, considering the hierarchical decision taken previously, by developing a Decision Support System (DSS) to manage daily the RMS. For a given quantity and variety of products to produce, how many resources are needed the considered day, where should they be assigned and what is the best scheduling of products.

Ergonomics and cognitivity are parts of the project for different purposes: the proposed DSS should be cognitive enough so the manager can easily take the right decision; an ergonomic study should be carried out while choosing the right resources in the shop floor.

Required background of the student:

Industrial engineering, robotics, operational research

A list of 5 (max.) representative publications of the group:

1. Klement N., Silva C. (2020) A Generic Decision Support Tool to Planning and Assignment Problems: Industrial Applications and Industry 4.0. In: Sokolov B., Ivanov D., Dolgui A. (eds) Scheduling in Industry 4.0 and Cloud Manufacturing. International Series in Operations Research & Management Science, vol 289. Springer, Cham. https://doi.org/10.1007/978-3-030-43177-8_9
2. S. Ehsan Hashemi Petroodi, Amélie Beauville Dit Eynaud, Nathalie Klement, Reza Tavakkoli-Moghaddam, Simulation-based optimization approach with scenario-based product sequence in a reconfigurable manufacturing system

- (RMS): A case study, IFAC-PapersOnLine, Volume 52, Issue 13, 2019, Pages 2638-2643, ISSN 2405-8963, <https://doi.org/10.1016/j.ifacol.2019.11.605>.
3. Amélie Beauville dit Eynaud, Nathalie Klement, Olivier Gibaru, Lionel Roucoules, Laurent Durville, Identification of reconfigurability enablers and weighting of reconfigurability characteristics based on a case study, *Procedia Manufacturing*, Volume 28, 2019, Pages 96-101, ISSN 2351-9789, <https://doi.org/10.1016/j.promfg.2018.12.016>
 4. Xia, Q., Etienne, A., Dantan, J.-Y., Siadat, A., 2018. Reconfigurable machining process planning for part variety in new manufacturing paradigms: Definitions, models and framework. *Computers and Industrial Engineering* 115, 206–219.
 5. Stief, P., Dantan, J.-Y., Etienne, A., Siadat, A., Burgat, G., 2020. Product design improvement by a new similarity-index-based approach in the context of reconfigurable assembly processes. *Journal of Engineering Design* 31, 349–377.
 6. El Mouayni, I., Etienne, A., Lux, A., Siadat, A., Dantan, J.-Y., 2020. A simulation-based approach for time allowances assessment during production system design with consideration of worker's fatigue, learning and reliability. *Computers and Industrial Engineering*
 7. M. Bounouar, R. Béarée, A. Siadat, N. Klement and T. Benchekroun, "User-centered design of a collaborative robotic system for an industrial recycling operation," 2020 1st International Conference on Innovative Research in Applied Science, Engineering and Technology (IRASET), Meknes, Morocco, 2020, pp. 1-6, doi: 10.1109/IRASET48871.2020.9092178.