Research Topic 09 for the ParisTech/CSC PhD Program

FOR APPLICATION, PLEASE CONTACT ADVISOR(S) BY EMAIL WITH COPY TO:
ali.siadat@ensam.eu AND yvon.velot@ensam.eu

Subfield: Industrial Engineering, Systems Engineering

ParisTech School: Arts et Métiers ParisTech campus de Metz

Title: Design Framework for Additive Manufacturing Based on Combined Product-Process Data

Advisors: Pr. Ali SIADAT ali.siadat@ensam.eu
Dr. Alaa HASSAN alaa.hassan@univ-lorraine.fr

Short description of possible research topics for a PhD:
Additive manufacturing (AM) is a key component of a new industrial revolution that brought huge impacts on the traditional manufacturing industry. As AM process evolves from rapid prototyping to the end-of-use product manufacturing process, manufacturing and design constraints have been significantly alleviated, including shape, material, hierarchical, and functional complexity. The growth of AM has mainly been process-driven. However, the evolution of engineering design to take advantage of the possibilities afforded by AM and to manage its associated data is still behind. Moreover, manufacturing should not be limited to AM because traditional fabrication processes are still reasonable. Cost and quality in terms of both the product and the manufacturing process need to be handled. Therefore, there is a real need to develop a method to better synthesize product specifications (functional, performance, and cost) and process knowledge (manufacturing, assembly, and cost) simultaneously. Different scenarios must be proposed in order to help designers knowing when and why using AM.

The main objectives of the proposal are:

1. Development of a tooled design approach considering product specifications and process knowledge simultaneously.
2. Proposal of a multi-criteria decision support to assess the benefits of using AM in a manufacturing system.

Required background of the student:
The candidate must have a master degree in industrial, mechanical or systems engineering. Skills in information system and programming will be appreciated.

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

[1] U. Khaleeq, A. Siadat, M. Rivette, and A. A. Baqai, "Integrated product-process design to suggest appropriate manufacturing technology : a review," *Int. J. Adv. Manuf. Technol.*, 2016. https://doi.org/10.1007/s00170-016-9765-z

[2] L. Chen, Y. He, Y. Yang, S. Niu, and H. Ren, "The research status and development trend of additive manufacturing technology," *Int. J. Adv. Manuf. Technol.*, vol. 89, no. 9–12, pp. 3651–3660, 2017.

[3] M. K. Thompson *et al.*, "Design for Additive Manufacturing: Trends, opportunities, considerations, and constraints," *CIRP Ann. - Manuf. Technol.*, vol. 65, no. 2, pp. 737–760, 2016.

[4] C. Comotti, D. Regazzoni, C. Rizzi, and A. Vitali, "Additive Manufacturing to Advance Functional Design: An Application in the Medical Field," J. Comput. Inf. Sci. Eng., vol. 17, no. 3, p. 31006, 2017.