

Research Topic for the ParisTech/CSC PhD Program

Subfield: Industrial Engineering, Production Engineering

ParisTech School: Arts et Métiers ParisTech campus de Metz

Title: Quality Management Framework for Additive Manufacturing Product and Process

Advisors: Pr. Ali SIADAT ali.siadat@ensam.eu

Dr. Alaa HASSAN alaa.hassan@univ-lorraine.fr

Dr. Lazhar HOMRI lazhar.homri@ensam.eu

Short description of possible research topics for a PhD:

Additive manufacturing (AM) is a key component of a new industrial revolution which is increasingly introduced in the traditional manufacturing industry. However, it is still hampered by low productivity, poor and uncertainty of final product quality. Moreover, manufacturing should not be limited to AM because traditional fabrication processes are still reasonable. In this context, it is critical to assess and ensure quality in order to achieve a reliable AM process. Many qualitative and quantitative methods are used to provide measures on manufacturing capability and to assess product quality. An adapted quality management framework is required to support the entire fabrication process chain. The topics to be addressed include software and data input, product understanding, AM equipment qualification, process understanding and continuous process verification. The interaction between input materials, process controls, and final outcomes of AM must be analyzed.

The main objectives of the proposal are:

1. Development of a quality management approach relating product specifications and process parameters in order to assess the final product quality.
2. Conducting case studies on products fabricated by Fused Deposition Modeling (FDM) process.

Required background of the student:

The candidate must have a master degree in industrial, mechanical or production engineering. Skills in production management and programming will be appreciated.

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

- [1] A. Hassan, A. Siadat, J. Dantan, and P. Martin, "Conceptual process planning – an improvement approach using QFD, FMEA, and ABC methods," *Robot. Comput. Integr. Manuf.*, vol. 26, no. 4, pp. 392–401, 2010.
- [2] H. Rostami, J. Dantan, and L. Homri, "Review of data mining applications for quality assessment in manufacturing industry: support vector machines," vol. 401, 2015.
- [3] H. Fei, X. Jinwu, L. Min, and Y. Jianhong, "Product quality modelling and prediction based on wavelet relevance vector machines," *Chemom. Intell. Lab. Syst.*, vol. 121, pp. 33–41, 2013.
- [4] W. Y. Yeong and C. K. Chua, "A quality management framework for implementing additive manufacturing of medical devices," *Virtual Phys. Prototyp.*, vol. 8, no. 3, pp. 193–199, 2013.
- [5] 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.