

Research Topic for the ParisTech/CSC PhD Program

Subfield: Industrial Engineering, Mechanical Engineering, Production Engineering

ParisTechSchool: Arts et Métiers ParisTech campus de Metz

Title:Development of process planning system for hybrid manufacturing

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Short description of possible research topics for a PhD:

The on-going industrial trend toward production of highly complex and accurate part geometries with reduced costs has led to the emergence of hybrid manufacturing processes where two or more manufacturing processes are combined whereby the advantages of each discrete process can be exploited synergistically. However, in this PhD thesis, the focus will be on additive and subtractive manufacturing process. Processes planning is to define the processes and the tools that will be used to manufacture specific part and to assemble a specific system. A typical process plan includes detailed drawings, routing sheets, material, tooling, fixtures, part programs, cost and time data. Research on process planning for subtractive processes has been widely developed since many decades. Nevertheless, it is necessary to take into account the potential of additive manufacturing technology in the industry of the future. Thus, the problem to be addressed is the combination between Additive and Subtractive Manufacturing to meet the industrial challenges in the reduction of tool wear and production time and cost and the increase of machining efficiency with specified tolerances and surface finish.

The main objectives of the proposal are:

1. Development of a process planning framework for additive/subtractive processes based on product features and process planning scenarios.
2. Proposal of cost and time estimation models for the process planning scenarios to find the best one.
3. Testing and validating the proposed framework using different industrial case studies.

Required background of the student:

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

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

- [1] Khaleeq U, Siadat A, Rivette M, Baqai A, 2016 "Integrated product-process design to suggest appropriate manufacturing technology : a review" Int. J. Adv. Manuf. Technol., DOI 10.1007/s00170-016-9765-z
- [2] Chu, Won-Shik, et al., 2014 "Hybrid manufacturing in micro/nano scale: A Review" International Journal of Precision Engineering and Manufacturing-Green Technology 1.1: 75-92.
- [3] Zhu Z, Dhokia V, Nassehi A, Newman ST, 2013 "A Review of Hybrid Manufacturing Processes - state of the art and future perspectives" Int J Comput Integr Manuf. 26 (7):596-615
- [4] Karunakaran K, Suryakumar S, Pushpa V, Akula S, 2010 "Low cost integration of additive and subtractive processes for hybrid layered manufacturing" Robot Comput-Integr Manuf. 26 (5):490-499