

Thesis proposal in Mechanics/Industrial Engineering

*A methodology to build an operating sequence for additive manufacturing
– Application to DED processes –*



Dates reminder

*Sending applications: before 1st June 2020

*Auditions: July 2020

*PhD start: September 2020



Location

*Main part of the PhD at ESTIA-Recherche (Bidart, France)

*Short periods with specific outputs and programme in the University of Wolverhampton (Telford Campus, UK)



Keywords

*Additive manufacturing

*Mechanical behaviour

*Performance indicators

*Process efficiency

*Decision support model

Background

Additive Layer Manufacturing (ALM) is an emergent technology that has a significant role in shaping the future of manufacturing. Many companies are more and more interested in such technologies to produce complex parts in more efficient way. However, uncertainties within the technological processes and the high investment costs discourage companies from implementing and systematically adopting this technology.

For instance, some efforts have been made to successfully build ALM parts and understand the interaction between the processing parameters and the resulting microstructures and mechanical properties of such parts. However, these studies are very often limited to a functional set of processing parameters, that limit the knowledge about the full potential of AM processes.

Plus, there is a key challenge to address economic, environmental and social aspects of ALM processes to ensure the sustainability of companies. Economic aspects of sustainability are mainly defined as manufacturing costs; environmental aspects are linked to energy and material efficiency, waste and emission reduction; while social aspects focus on employees, customers and communities. Nowadays, little attention has been given to this topic, especially for environmental aspects.

In the southwest region of France, the laboratory ESTIA-Recherche and Addimadour (R&D platform) work jointly to develop and improve the knowledge on ALM processes, in particular on metallic parts produced by Direct Energy Deposition (DED) processes.

The “Communauté d’Agglomération Pays Basque” (CAPB) has chosen for its plan “Factory of Future” to support scientific research on metallic ALM technologies at ESTIA.

This research project is complementary to those already undertaken in the ESTIA Recherche laboratory and the Addimadour platform. The main challenge of this multidisciplinary project (mechanical and industrial engineering) is thus to enhance the knowledge on ALM processes and their future transfer to companies.

Scientific topic

Previous research studies and relative publications mentioned that there is a need to carry on exploration on ALM processes, in particular to:

- propose complete ALM processes maps for determining the best set of process parameters for any given application,
- pay attention to environmental, economic and social aspects,
- combine engineering and industrial approaches, that is essential for the transition of a new technology from research to industry.

So, the expected contribution of this research work is to assist the definition of both the operating sequence and its operating set of parameters for specific series of parts using a specific ALM process.



Doctoral school

The candidate will be enrolled at Physics and Engineering Doctoral School of the University of Bordeaux.



Scientific supervisors

*Director: Pr. Christophe MERLO

*Co-supervisors: Dr. Julie LARTIGAU and Dr. Laura LAGUNA SALVADO



Financial support

*PhD salary: CAPB

*PhD displacements: ERASMUS+ funding

*Technical expenses: ESTIA or other sources

Firstly, the global set of parameters involved in the studied process will be defined and their relative influence on the manufacturing of specific parts will be characterized. It will include manufacturing operations supervision and post-process controls such as mechanical destructive tests and metallurgic observations.

Also, it is necessary to identify and quantify relevant performance indicators (both process and organizational) for decision makers. Interviews with experts from Addimadour and SMEs will be considered.

Then, a decision support model will be designed, developed and validated, from experimental investigations. For instance, it will provide maps and procedures to determine the best set of operating parameters to reach specific performance indicators. Thus, it will guide the choice of input operating parameters during the manufacturing step, while considering at least (i) process efficiency, (ii) mechanical performance and (iii) metallurgic state of produced ALM parts.

Required profile

Education – The candidate must be graduated by a master or engineering diploma with a specialization in Mechanics and/or Industrial Engineering.

Previous internships on a research laboratory or in a company working on ALM applications will be highly appreciated. English writing/speaking candidates (mother tongue or high level) are expected. The knowledge of French language is an asset.

Recommended scientific skills

- Manufacturing: processes, operating sequences
- Strength of materials
- Metallic alloys
- Experimental techniques: characterization of static mechanical behaviour and metallurgic observations
- Data analysis
- Design of experiments
- Knowledge modelling
- Multicriteria decision tools and techniques

Other abilities – The candidate must be sociable, curious, autonomous and rigorous. The candidate should be able to speak about his project with industrial and academic partners. Also, the candidate should be interested in teaching in English and/or in French.

Application

The application must include a CV and a covering letter. If possible, a letter of recommendation or the name of a referee could be added to the application. Application must be sent by email to Ms. Julie LARTIGAU before 1st June 2020: j.lartigau@estia.fr

Selected candidates will be invited to meet the scientific supervisors during an audition, at the latest in July 2020.

For further enquiry, please contact Julie LARTIGAU
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