Optimization method and sizing of latticed and/or dense tubular structures zones in metal additive manufacturing, especially for heat exchanger.

INP-Toulouse-ENIT + Alstom

NICOLAS BAUDIN
INTERNSHIPS IN FRANCE INITIATIVE

Name of the hosting institution in France	INP-Toulouse-ENIT
Name of the host laboratory / research team	LGP-ENIT
Address	47 av. d'Azereix 65000 Tarbes
Web site	http://www.enit.fr/en/index.html
Name of the supervisor	Lionel ARNAUD
Function	Assistant professor, scientific responsible of 3D metal printing platform hwww.cef3d.fr
Email	lionel.arnaud@enit.fr
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Internship offer

Topic of the internship (title)	Optimization method and sizing of latticed and/or dense tubular structures zones in metal additive manufacturing, especially for heat exchanger.			
Proposed dates of the internship	**Start:**	2019-09-02	**End**	2020-01-31

Scientific and academic objectives of the internship (detailed description of the internship content, work expected from the intern and expected outcomes):

Powder bed laser melting (SLM) additive manufacturing (FA) is a mature manufacturing process that can be used cost-effectively by manufacturers for prototyping and sometimes for mass production. Nevertheless, lattices and/or dense tubular structures, which are a major asset of this process, are still very little used, especially because there is no practical method of choice, optimization and sizing of these structures. The proposed subject concerns a methodical analysis of these structures in order to identify rational choice criteria and robust design methods. The two main scientific obstacles are: - The analysis of existing structures and their categorization according to criteria useful for the designer (for example: manufacturability, weight, stiffness, anisotropy, Poisson coefficients, elastic or fracture resistance, fatigue, resilience, toughness, thermal conductivity, resistance to fluid flows, global heat exchange coefficient, etc.) - Definition of robust characterization methods (ie definition of test specimens and tests to objectively compare different families), and taking into account the uncertainties inherent in the presence of significant manufacturing defects of the elementary pattern's scale (in particular surface roughness and porosity). Objectives and planning The work aims to methodically, i.e. with numerical and experimental tests of 3D metal printed samples, design complex parts with lattices and/or dense tubular structures, print them and test them.
Step 1: Basic bibliographic study on the characteristics of lattices structures and/or dense tubular structures in SLM. and the methods of characterization of these properties (by mechanical tests and F.E.M.)
Step 2: Take into account manufacturing defects to obtain robust models.
Step 3: Implementation of test cases with lattices and/or dense tubular structures.
Step 4: metal printing, and mechanical testing.

Name of industrial partner	Alstom (and possibly Safran).
Role of the industrial partner in the internship project	The designed is based on Alstom needs (and possibly Safran), several meetings in France will allow the student to interact with the industrial partners. The parts to be designed will be chosen to be useful to both French and Australian branches.
Main contact at the French industrial partner	Pierre Solomala (Alstom)
Main contact at the French industrial partner's branch in Australia (if applicable)	To be defined (Alstom Melbourne)
Targeted Australian university	Any

Expected profile of applicant

Discipline	Mechanics
Required qualities, knowledge and skills	Innovative design for additive metal manufacturing (SLM) Mechanics, manufacturing processes

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