

Research Topic for the ParisTech/CSC PhD Program

***Field (cf. List of fields below): Materials Science, Mechanics, Fluids**

Subfield: Mechanical Engineering, Numerical Methods, Applied Mathematics

Title: Topology Optimization of Additive Manufactured Parts including fatigue behavior

ParisTech School: Arts et Métiers ParisTech

Advisors:

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Short description of possible research topics for a PhD:

In additive manufacturing processes, parts are manufactured layer by layer. Such techniques allow the creation of complex structural designs that other classical processes cannot produce. Efficient numerical tools to generate automatically optimal structure satisfying some requirements are provided by topological optimization methods. However, standard topological optimization formulations for light weighting produce designs with stress concentrations and singularities that cause a reduction in fatigue life. The proposed work deals with the development of a new numerical tool to design lightweight but also fatigue-constrained topologically optimized structures for additive manufacturing. The prediction of this new tool will be compared to some experimental results generated during the thesis.

Required background of the student:

The candidate should have a strong background in Mechanical Engineering, Materials Science and Engineering or Numerical Methods. Although prior knowledge of the French language is not mandatory, spoken and written English proficiency is needed.

A list of 5(max.) representative publications of the group: (Related to the research topic)

N. Torabian, V. Favier, J. Dirrenberger, F. Adamski, S. Ziaei-Rad, S., N. Ranc, Correlation of the high and very high cycle fatigue response of ferrite based steels with strain rate-temperature conditions, *Acta Materialia*, 134, 40-52, 2017.

I. Koutiri, E. Pessard, P. Peyre, O. Amlou, T. DeTerra, Influence of SLM process parameters on the surface finish, porosity rate and fatigue behavior of as-built Inconel 625 parts, *Journal of Materials Processing Technology* 255, 536-546, 2018.

E. Monteiro, H.-B. Ly, G. Regnier, M. Dal, On the factors affecting porosity dissolution in Selective Laser Sintering Process, *AIP Conference Proceedings* 1960, 120014, 2018.