6 months Engineer / Post-doctoral position at LaMCoS (INSA-Lyon)

Title : Development of a numerical tool dedicated to the virtual control of metallic additive manufacturing processes using reduced order modeling.

Contacts:
Thomas ELGUEDJ, PU, LaMCoS (thomas.elguedj@insa-lyon.fr)
Nawfal BLAL, MCF, LaMCoS (nawfal.blal@insa-lyon.fr)
Arnaud DUVAL, IR CNRS , LaMCoS (arnaud.duval@insa-lyon.fr)

Framework
MELTED (MastEring the quaLity of addiTive manufacturED parts) is a project supported by the Carnot Institute I@L (http://www.ingenierie-at-lyon.org/en/). Several academic and industrial partners from Lyon-Saint Etienne area are involved. The project aims at providing tools to control the residual state of direct energy deposited (DED) metallic parts. This additive manufacturing process builds geometry by blowing metallic particles in a laser molten substrate. The thermal history of such parts is complex and heterogeneous. The thermal-metallurgical couplings are responsible of heterogeneous residual states in terms of microstructure (phases, porosity) and residual stress. The control of this manufacturing level is necessary to guarantee the final state of the piece. The MELTED project couples process monitoring with on-line multiscale and multiphysics simulations in order to control the parameters of the DED process in a closed loop manner.

Job description
The recruited person will be responsible for the development of a numerical tool dedicated to the virtual control of SLM and DED additive processes. The tool will be based on a posteriori reduced order models already developped at Lamcos for the numerical simulation of welding (PhD thesis of Ye LU, AREAVA-Safran chair). The aim is to implement an efficient tool fully automated that can launch hundreds of off-line large scale computations, also called snapshots, using different finite element codes. Those costly calculations are done once and will be stored in an appropriate database as functions or modes using a separated representation. Only the modes that contribute significantly to the solution of the problem at hand will be kept. The on-line phase of the ROM approach will consist in interpolating in an adequate fashion those modes to obtain the solution of a new set of parameters without having to run a full, numerically expensive, calculation. The developed tool will have to be optimized so that the interpolation phase is as fast as possible. This is crucial if we want to reach to goal of on-line control of additive processes. The approach will be validated by setting up a platform for the virtual control of SLM or DED processes.

Expected profile
Applicants will have an master degree or a PhD in applied mathematics, computational mechanics or in informatics with a good knowledge of mechanical engineering and high performance computing.
A large experience in software development (finite element or other discretization methods) and HPC is mandatory, if possible with modern programming languages such as C/C++, python, etc. Applicants with a knowledge of reduced order modeling (POD, PGD, …) as well as experience in the simulation of thermo-mechanical processes (Additive Manufacturing, welding, …) will be considered with attention.

Conditions
Duration: 6 months. Salary: between 1850€ and 2050€ gross per month, based on expertise. Beginning of contract: as soon as possible, no later than September 30th 2018.