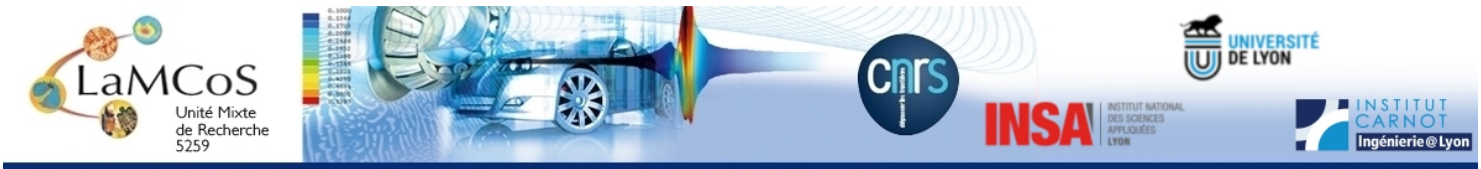

One year post-doctoral position at LaMCoS (INSA-Lyon) in collaboration with EDF R&D

Title : Finite Element modeling of the particle-substrate adhesion in the Cold Spray additive manufacturing process

Contact :

LaMCoS, INSA de Lyon	EDF R&D Saclay
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Framework

The Cold Spray additive manufacturing process consists in the high velocity projection of powder particles (mostly metallic, but ceramics and polymers can also be used) on a substrate to create a coating. This process is defined as cold, as the powder is only heated up to a few hundreds of degrees, and therefore below the melting temperature. The creation of the coating is done by converting the kinetic energy of the powder (velocity up to 1000m/s) into plastic strain energy. Two phenomenon take place in this process when the proper combination of parameters is used: shear bands and cohesive adhesion between the particles and the substrate or between the particles and the first coating layers.

Job description

During previous work done at Lamcos on this topic, we developed a numerical model in explicit dynamics that couples FEM with meshless methods (SPH) in the transient code EUROPLEXUS. This includes a Johnson Cook damage model to reproduce the shear bands and a cohesive model with activation-deactivation features to represent the adhesion phenomenon of the particles on the substrate. This model can represent the impact of a single particle on the substrate. The numerical constraints imposed by the SPH method (total Lagrangian approach, high numerical cost) versus the advantages (no remeshing needed) make its use beyond the proof of concept very difficult. The objective of the post-doc is therefore to transpose and adapt this model and the associated algorithms to a pure finite element model in EUROPLEXUS. Because of the very high strains encountered in Cold Spray, adaptive remeshing with field transfer and/or element erosion (already available in EUROPLEXUS for moderate stain levels) will have to be considered.
The post doc will focus on the modeling of single impact cases with 316L stainless steel particles on a 316L stainless steel substrate. The material parameters for the Johnson Cook model will have to be identified either form data available in the literature or at EDF.

Expected profile

Applicants will have a PhD in computation mechanics or in informatics with a good knowledge of solid mechanics. A large experience in software development of finite elements or similar methods is mandatory. Experience in Python or Fortran programming languages and/or explicit dynamics will be considered carefully.

Conditions

Duration: 12 month, starting fall 2019. Salary: 1900€ net per months. Location: INSA-Lyon, Villeurbanne 69, France.