LAMIH
LABORATOIRE D'AUTOMATIQUE DE MECANIQUE ET D'INFORMATIQUE INDUSTRIELLES ET HUMAINES
UMR 8201 CNRS-UVHC

Valenciennes, 16 July 2014

Post-Doctoral Position in Computational Mechanics

Context

LAMIH UMR CNRS 8201 (Laboratory of Industrial and Human Automation control, Mechanical engineering and Computer Science) is a joint research unit between University of Valenciennes and Hainaut-Cambresis (UVHC) and the National Centre for Scientific Research (CNRS). LAMIH is strongly involved in R&D related to sustainable transports and mobility. The Crash Comfort and Safety (C2S) research team of its Mechanical Engineering Department is currently a partner of a project funded by the National Research Agency (ANR). This project, called ASAP, aims at:

- improving the automotive safety by developing a new non destructive method for inspection of spot welds correlated with experimental data of destructive tests under quasi-static and dynamic combined tension and shear loadings ;
- improving the numerical modeling of spot welds' behavior and rupture for crashworthiness FEA.

The consortium of partners implies Renault, the French Commissariat à l'Energie Atomique (CEA LIST), and the SMEs M2M. C2S team of LAMIH is in charge of destructive experiments and FE modeling of spot welds strength in an explicit fast dynamics numerical code.

Modeling of the strength of spot-welded assemblies

Two kinds of FE modeling can be distinguished: the so-called mesoscopic and macroscopic ones. On the one hand, the mesoscopic modeling corresponds to a finely meshed discretization of the weld geometry and material zones (Fusion Zone, Heat Affected Zone, Base material). On the other hand, a connector representing globally the non-linear behavior and failure of the spot-weld is adopted in the macroscopic modeling. In fact, due to computation costs, the macroscopic modeling is the only approach currently admissible in order to model full-scale car bodies subjected to fast dynamics loadings. However, it appears that existing connectors are not satisfactory when modeling multi-sheet metal spot-welded assemblies. An additional difficulty also relies in the use of multiple grades of steel in the multi-sheet assemblies. Both a multi-node formulation and a suitable rheological model including rupture are thus required for the connector model to be developed.

Essential duties

- Participate to the post-treatment of the experiments in order to build models (in particular failure criteria that take into account non-destructive data).
- Develop a macroscopic multi-sheet multi-material spot-weld finite element model to be integrated in an explicit fast dynamics numerical code. On the one hand, the formulation of the connector will be developed such as to connect any number of sheets. On the other hand, the rheological model and in particular the rupture criteria will be designed such

that a macroscopic model featuring the developed connector allows obtaining a good agreement with the global force-displacement experimental responses.

- Present and disseminate research results at scientific conferences and in peer-reviewed publications.
- Interact with the members of the consortium.

Essential skills, knowledge, and abilities

- PhD in Mechanical Engineering, Computational Mechanics, or related field.
- Finite Element modeling and computations.
- Developing and implementing new numerical algorithms.
- Programming experience/fluency in FORTRAN (or C++).
- Experience working independently in a research environment.
- Demonstrated communication skills (scientific reports, publications, presentations).

Keywords: Explicit FE code, Numerical implementation, Mechanical strength of connectors and assemblies, Macro modeling, Structural computations.

Duration: 1 year starting from October 2014.

Salary: 2170 Euros gross

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