

Research Topic for the Arts et Métiers ParisTech - CSC PhD Program

Subfield: Mechanical Engineering

ParisTech School: Arts et Métiers ParisTech

Title: Modeling of formation and evolution of adiabatic shear bands in rate-sensitive polycrystalline metals.

Advisor(s):

- Farid ABED-MERAÏM (Full professor): farid.abed-meraim@ensam.eu
- Mohamed JEBAHI (Associate professor): mohamed.jebahi@ensam.eu

Short description of possible research topics for a PhD:

As an inevitable outcome of thermoplastic instability, induced under high strain and high strain rate, adiabatic shear band localization has been a topic of great interest to engineers and researchers since its first recognition. Numerical simulation of such a phenomenon represents one of the most challenging issues, not only because of the complexity of the involved mechanisms, but also because of the numerical difficulties that prevent an accurate representation of the localization process. One of these issues is the well-known non-physical dependence of the solution on the mesh topology. Although several regularization strategies have been proposed in the literature to deal with this problem, accurate modeling of localization remains very challenging and requires additional research effort. The goal of the present PhD proposal is to corroborate the existing works on the modeling of adiabatic shear bands, on the one hand, by taking into consideration the recently identified mechanisms that take place in these bands and, on the other hand, by implementing robust regularization strategies to properly simulate their formation and evolution, while accounting for interactions between them.

Required background of the student:

Computational mechanics, Material behavior, Material instability

A list of 5 (max.) representative publications of the group:

- [1] Bouktir, Y. and Chalal, H. and Haddad, M. and Abed-Meraim, F., *Investigation of ductility limits based on bifurcation theory coupled with continuum damage mechanics*, Materials & Design 90 (2016), pp. 969-978.
- [2] Ben Bettaieb, M. and Abed-Meraim, F., *Investigation of localized necking in substrate-supported metal layers: Comparison of bifurcation and imperfection analyses*, International Journal of Plasticity 65 (2015), pp. 168-190.
- [3] Akpama, H. K. and Ben Bettaieb, M. and Abed-Meraim, F., *A comparative study of Forming Limit Diagrams predicted by two different plasticity theories involving vertex effects*, Key Engineering Materials 651-653 (2015), pp. 21-26.
- [4] Mansouri, L. Z. and Chalal, H. and Abed-Meraim, F., *Ductility limit prediction using a GTN damage model coupled with localization bifurcation analysis*, Mechanics of Materials 76 (2014), pp. 64-92.
- [5] Abed-Meraim, F. and Peerlings, R. H. J. and Geers, M. G. D., *Bifurcation analysis versus maximum force criteria in formability limit assessment of stretched metal sheets*, International Journal of Applied Mechanics 6 (2014), pp. 1450064.

FOR APPLICATION, PLEASE CONTACT ADVISOR(S) BY EMAIL WITH COPY TO:

ali.siadat@ensam.eu AND yvon.velot@ensam.eu