Research Grants for PhD students from the China Scholarship Council

Information Form (please read the guidelines carefully on the website www-csc.utt.fr)

Supervisor's name : NACEUR   Given names : Hakim

Status (prof., assistant prof., …) : Professor

Laboratory : LAMIH UMR 8201 CNRS   Website address : https://www.uphf.fr/LAMIH

Institution : INSA Hauts-de-France   Website address : https://www.insa-hautsdefrance.fr

Scientific competence of the supervisor:

SPH modeling; Shell Finite Element; Stamping; Hydroforming; Meshless; Plasticity; Damage;

Two major publications in the field proposed for the PhD :

1. J Lin, H Naceur, D Coutellier, S Abrate (2015) "Numerical modeling of the low-velocity impact of composite plates using a shell-based SPH method", Meccanica, 50, pp. 2649–2660

2. J Li, G Wang, S Liu, J Lin, Y Guan, G Zhao, H Naceur, D Coutellier (2021) "Efficient thermomechanical analysis of functionally graded structures using the symmetric SPH method", Case Studies in Ther Eng, 25, 100889

Website address of the personal page : http://naceurh.free.fr

Supervisor's email : hakim.naceur@insa-hdf.fr

Description of the research work proposed for a PhD   **Topic # (see list) :** IV-6, IV-12, IV-13,

Title : Numerical modeling of thermoforming process of thermoplastics using shell based SPH method

Subject :

This thesis deals with the numerical modeling of thermoplastic structures based on the coupling of the "Shell Smoothed Paticle Hydrodynamics (SSPH)" with a thermo-viscoplastic material model for the simulation of thermoforming process. The developed shell SPH model, will be extended to large viscoplastic strains. Compared to FEM, the advantage of the SSPH lies in the absence of elements, allowing to capture naturally all defects and shape distortions which often arise during thermoforming of thermoplastic structures. A second part of the thesis work will concern the optimization of process parameters such as temperature and pressure in order to design guidelines for thermoplastic forming process which will help to prevent such defects and permits the formability of the final workpiece. The numerical developments will be done with Python at first and then will be implemented in the open-source software OpenRadioss. Indeed, this software offers numerous advantages such as contact algorithms and various time integration schemes. For the validation of the SSPH model, several benchmarks of thermoforming of thermoplastic shells will be evaluated and the results will be compared to those obtained by experiments and the classical finite element method.This research thesis is original and has never been addressed by the international scientific community of thermoplastics forming; hence the developments will allow the publication of several articles in peer-reviewed international journals.

Keywords :

Numerical modeling; thermoforming; SPH; optimization; process parameters;

Expected collaborations :

The PhD thesis will be done at INSA Hauts-de-France in collaboration with Prof. Valentina LOPRESTO, Department of Chemical, Materials and Industrial Production Engineering, University of Naples Federico II, Naples, Italy

Background required from the applicant :

Expected candidate should have basic knowledge of forming processes, finite element and basics of programming.

Existence of a PDF file detailing the proposal ("yes" or "no") : yes

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