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[CN 29] D. TRUFASU, **A. GAVRUS**, G. ANDREI **–** *"Analyse du Comportement Mécanique du PEEK et du PEEK Renforcé avec des Fibres de Carbone et Nanotubes de Carbone",* MATERIAUX 2010, Nantes, 18-22 Octobre 2010.

[CN 30] A. BESNEA, **A. GAVRUS**, G. ANDREI **-** *"Etude Expérimentale et Numérique de la Rheologie des Composites à Matrice PPS (Polyphenylene Sulfure)",* MATERIAUX 2010, Nantes, 18-22 Octobre 2010.

[CN 31] H. FRANCILLETTE, **A. GAVRUS** - *"Caractérisation d'un alliage de zirconium deformé par laminage"*, SF2M Section Ouest & 42ème Journée d'Etude sur la Cinétique Hétérogène, pp. 26, La Rochelle, 29-31 Mars 2011.

[CN 32] A. GAVRUS –*"Principes d'Apprentissage et d'Evaluation dans l'Enseignement de la Mécanique Appliquée. Conception et Cohérence Cours - Travaux Dirigés - Travaux Pratiques"*, 20ème Congrès Français de Mécanique CFM'2011, Colloque C2 : Formation & Pédagogie, Poster, Besançon, France, 29 Août – 2 Septembre 2011.

[CN 33] D.T. PHAM, **A. GAVRUS**, H. FRANCILETTE – "La conception optimale d'un test d'extrusion directe pour l'identification des lois sur les frictions des matériaux métalliques", 9ème Conférence de l'Education Nationale, Hanoi, Vietnam, 8-9 Décembre 2012.

[CN34] H. FRANCILLETTE, **A. GAVRUS**, D. T. PHAM - *"Etude microstructurale de la déformation par extrusion à froid d'un alliage d'aluminium AA5083"*, Journée SF2M Section Ouest sur la Caractérisation des matériaux : Méthodes et Essais spécifiques, Lorient, France, 4 Avril 2013.

[CN 35] Liva RABEMANANJARA, Gérard MAUVOISIN, **Adinel GAVRUS**, Xavier HERNOT, Jean Marc COLLIN- *"Etude du comportement mécanique du Polycarbonate par indentation conique",* Journée SF2M Section Ouest sur la Durabilité des matériaux: endommagement, dégradation, fatigue et rupture, Tours, France, 17 Avril 2014.

[CN 36] Liva RABEMANANJARA, Gérard MAUVOISIN, **Adinel GAVRUS**, Xavier HERNOT, Jean Marc COLLIN - *"Formulation de Déformation Représentative et de Vitesse de Déformation Représentative par Indentation Conique",* Colloque Indentation 2014, Institut Charles Sadron, Strasbourg, France, 10-12 décembre 2014.

[CN 37] E. PIRVA, **A. GAVRUS**, A. TUDOR, N. STOICA et S. CANANAU- "Anisotropie et Caractère Fractal du Frottement pour des Contacts Tribologiques AA2024-T351/ UHMWPE", 30ème Journées Internationales Francophones de Tribologie JIFT 2018, pp. 22-23, Sophia Antipolis, France, 16-18 Mai 2018.

University Scientific Sessions

A**. GAVRUS**, M. CARUNTU - *"Les mesures des caractéristiques qualitatives",* Session Nationale Scientifique Universitaire, Timisoara, Romania, oct. 1988.

N. CHIFAN, **A. GAVRUS** - *"La modélisation numérique pour l'analyse de la migration de la pollution souterraine et en surface dans un milieu aquatique",* Session Nationale Scientifique Universitaire, Timisoara, Romania, oct. 1989.

A. GAVRUS, N. OANCEA - *"Une méthode de calcul numérique pour le détalonnage de la fraise mère hélicoïdale",* Session Scientifique de l'Université de Galati, Romania, mai 1991.

A. GAVRUS, E. TARU- *"La projection assistée par ordinateur des outils à gorges extérieures pour les cannelures à flancs parallèles",* Session Scientifique de l'Université de Galati, Romania (1st Prize), mai 1991.

A. GAVRUS, I. CRUDU **-** *"Les principes de projection d'une chambre acoustique pour les études tribologiques"*, Session Scientifique de l'Université de Galati, Romania, mai 1991.

Research Reports

A. GAVRUS, L. MOCANU - "*Recherche des courbes limites d'emboutissage (lors des essais de traction)"*, CEMEF, Rapport de Stage, ENSMP (France), avril 1992.

A. GAVRUS - *"Problèmes inverses en mécanique des solides. Identification paramétrique"*, Rapport Bibliographique de DEA, CEMEF, Ed. ENSMP (France), avril 1993.

A. GAVRUS - "*Identification automatique des paramètres de comportement par une méthode de rhéologie assistée par ordinateur"*, Rapport de Stage de DEA, CEMEF, Ed. ENSMP (France), juillet 1993.

A. GAVRUS - *"Simulation par éléments finis du comportement viscoplastique: formulation de la loi et identification des paramètres rhéologiques",* Rapport Interne, ACR2/GTF, décembre 1995.

A. GAVRUS, E. MASSONI - *"Formulation des lois de comportement, caractérisation rhéologique et analyses numériques",* Rapport Interne, ACR2/GTF, juin 1997.

Scientific Seminaries, Colloquies & Workshops

Séminaire National "La modélisation des procédés spéciaux de mise en forme", Univ. Galati, Romania, 9 avril 1996.

Journées des Jeunes Rhéologues, Grenoble, France, Groupe Français de Rhéologie (GFR), 6-7 juin 1996.

Séminaire Franco-Roumain "La modélisation des procédés spéciaux de mise en forme", Université de Galati, Romania, 18-22 novembre 1996.

Réunion Internationale "Base de données WeDaBas", ACR2/GTF (France) - CPM (Allemagne), Maison de la Mécanique, Paris, 10 juin 1996.

Journées bilan de la 1ére année de l'Action concertée de recherche: Simulation du forgeage (GPI Forge/ACR2), Saint-Etienne, France, organisé par le groupe de travail ACR2, 23-24 octobre 1996.

Workshop International "Modelling in Material Science and Processing Materials", Projet Européen COST 512, présentation du poster: E. Massoni, **A. Gavrus**, J. L. Chenot, « *Parameter Identification Using a Computer Aided Rheology Method* », Suisse, novembre 1996.

Séminaire OPTIMUS – "Mise en évidence des chemins langrangien de contraintes parcourus depuis la pièce vers le copeau – illustration dans le plan déviatorique ", Bordeaux, France, mai 2004.

15th Technical Meeting of DYMAT – " Mechanical and Physical Behavior of materials under dynamic loadings : Crashworthiness and constitutive relationships for engineering materials", Metz, France, 1-2 June 2004.

Journées Modélisation et Rhéologie de la Coupe **: "***Simulation numérique en grande déformation : défis numériques et couplages pour la rhéologie*", ENSAM de Bordeaux-Talence, 20-21 mars 2008.

Séminaire Franco-Roumain: "Etude du comportement des structures métalliques en conditions sévères de déformation", 12 Juin 2008, Univ. de Galati, Romania (organisateurs : **A. GAVRUS**, C. MAIER, V. PAUNOIU).

*Séminaire OPTPAR – "Techniques d'optimisation pour les procédés de mise en forme des matériaux***"**, Université de Galati, Romania, Février 2009.

Séminaire International "Contemporary Analysis and Representation Methods of Physical Phenomena. Industrial Applications"- présentation intitulée: *"Analysis and Modeling of Metallic Structures Behavior to Impact Loadings"*, Faculté de Science, Université de Galati, European Program POSDRU, Romania, 25 Février 2010.

Workshop International "Titanium alloys for automative, aerospace and biomedical applications", INSA Rennes, France, 3 – 5 Mai 2010.

Séminaire International "Inverse Engineering and Inverse Analysis : Fundaments and Applications", Faculté de Science, Université de Galati, European Program POSDRU, Romania, 24 Juin 2010.

Séminaire POSDRU *"Advanced Experimental and Numerical Methods in Engineering Design and Research ",* Faculté de Mécanique, Université de Galati, European Program POSDRU - Eficient, Romania (organisateur **A . GAVRUS** – Short Term Expert POSDRU – Eficient UGAL, Romania), 29 Juin 2010 – 2 Juillet 2010,.

Séminaire – "Inverse Problems and Engineering Applications", Faculté de Mécanique, Université de Galati, Romania, Nov. 2010.

2ème Journée Scientifique de Jeunes Chercheurs – "Mesure, Modélisation et Simulation", Exposé: *"Problèmes Inverses et Applications dans le Domaine de l'Ingénierie",* MMS'2011, INSA Rennes, France, 23 Juin 2011.

Séminaire – Journée d'Etude - "Etudes Expérimentales et Numériques des Procédés de Formage Non-Conventionnels. Influence des Propriétés Mécaniques du Matériau et Méthodes d'Analyse et d'Identification. Exposé sur *"Problèmes Inverses en Mécanique des Matériaux : Principes et Applications"*, LGCGM/PSM, INSA Rennes, France, 23 Septembre 2011.

Forum Ouvert – "Comment Ecobâtir pour mieux vivre ensemble le territoire". Participation comme Membre du Groupe de Travail pour la mise en place du « *Pôle Technologique Eco-Construction* » du Pays de Fougères - Projet ECOBATYS. Table Ronde : *l'Autonomie Energétique et l'Eco-Construction : "Eco-Conception en vue d'optimiser l'impact sur l'environnement (Bilan optimal, Eco-Matériaux, Optimisation du flux énergétique)"* et Atelier Débat : *"Mutualisation des Outils, Compétences & Qualifications"*, Romagné - Pays de Fougères, France, 9-10 Fév. 2012.

Café Scientifique – Laboratoire GCGM/INSA Rennes, Exposé A. Gavrus : *"Le défi actuel dans la recherche en mécanique des matériaux: Méthodes d'Etudes de type Conception Intégrée"*, Ecole Doctoral INSA Rennes, France, 6 Juin 2013.

Les rencontres de la Recherche de l'IAUR – "Nouveau outils de co-conception et d'éco-construction (autour du Projet ECOBATYS Pays de Fougères)", Exposé A. Gavrus *: "Méthodes de conception intégrée et d'ingénierie inverse appliquées à l'étude du comportement non-conventionnel des matériaux et de l'analyse des performances énergétiques"*, Javené – Chauvigné, Pays des Fougères, France, 12 Décembre 2014.

Séminaire Scientifique – Exposé A. Gavrus : *"New Experimental And Numerical Methods for Investigation of Materials Tribologic Properties During Industrial Bulk Forming Processes* ", University Politehnica Bucarest (Roumanie), Laboratoire OMTR – Faculty FIMM/UPB, 4 Juillet 2017 (environ 15 participants : 10 Enseignants-Chercheurs et 5 Doctorants).

Plenary Lecturer – 1st Edition of the Space Launching Systems and of the 13th Edition of the International Conference on Design, Modeling and Optimization in the field of Aerospace Robotics, Manufacturing Systems,Mechanical Engineering, Bioengineering, Power and Energy Engineering, Materials Engineering and Neurorehabilitation , Exposé A. Gavrus : *"Relationships between the AFM and UASTRO in context of the future collaboration - GTT International Relationship of AFM",* 29 Juin 2018, SLS&OPTIROB 2018, Constanta-Jupiter, Romania, 29 Juin – 2 Juillet 2018 (environ 15 participants).

Panel C5 – Colloque Franco-Roumain en hommage au Prof. C. TEODOSIU, "Plasticité des matériaux polycristallins: mécanismes, modèles constitutifs, approches multi-échelles", Exposés P. Y. Manach, A. Gavrus : *"Collaborations France-Roumanie et Francophones en Mécanique des Matériaux et Plasticité" - Actions Francophones du GTT Relations Internationales AFM*" (Exposé P.-Y. Manach), Historique Collaborations Francophones France-Roumanie depuis les années 1990 (Exposé A. Gavrus), "*Echanges, discussions et débats autour de la Mécanique Francophone*", 27 Août 2019, CFM'2019, Brest, France, (environ 20 participants).

Séminaire Scientifique – Laboratoire LCFC-ENSAM Centre de Metz, Exposé A. Gavrus : *"Constitutive Laws and Modelling Approaches Concerning Elasto-Plastic Behaviour of Severe Materials Forming and Structures Loadings by Inverse Analysis and Inverse Problem Formulation",* 2 Avril 2019 (10 participants dont 6 doctorants).

RDV Performance – SCIC ECOBATYS, Exposé A. Gavrus : *"Mix d'énergies renouvelables et autonomie énergétique en contexte domestique - L'Eolienne Hélicoïdale à l'Axe Verticale RoDaVi – Aircrafted/Premiers essais de l'éolienne RoDaVi en vidéo*", Ecobatys, ZA Saint Eustache – Maen Roch, 35460 Saint Etienne en Coglès, France, 5 décembre 2019 (10 participants) - http://www.ecobatys.bzh/dates/rdv-performance-mix-denergies-renouvelables-et-autonomie-energetique-en-contexte-domestique/

Scientific Seminary Doctoral School of UDJG - Univ. « Dunarea de Jos de Galati », Roumanie, Keynote Lecturer 24 hours A. Gavrus : *"New trends in numerical modeling and experimental characterization of advanced materials behavior"* ; Plenary Lecturer: 1. New Trends on Numerical and Experimental Materials heology and Tribology Analysis with Applications to Rapid and Severe Forming Processes; 2. Constructal Theory Application of Prof. A. BEJAN to proof the Maximal Work Principle in Material Flows and Plasticity using an Optimal Variational Computation; 3. and 4. Recent Numerical and Experimental Improvements to Analyze the Structures and Materials behaviour under Choe, Impact and Severe Loadings using a SHPB Mechatronic Propulsion System and Non-Conventional Devices, 25 – 28 February 2020 (15 participants from which 10 PhD students).

Teaching Documents

A. GAVRUS – *"Numerical Methods: Part I: Optimisation Problems, Part II: Inverse Problems Principles and Engineering Applications",* 105 pages, Master Research, Printed Course INSA Rennes, 2012-2020.

A. GAVRUS, F. LOMINE, F.BERNARD – *"Etudes Numériques et Méthodes d'Analyse Optimale d'une Structure Réduite de la Tour Eiffel "*, 45 pages, Master Research, Printed Project INSA Rennes, 2012-2020.

A. GAVRUS – *"Matériaux Métalliques: Applications à la Mise en Forme*", 171 pages, 5th Student Year, Printed Course INSA Rennes, 2001-2020.

A. GAVRUS – *"Matériaux Non-Métalliques: Applications à la Mise en Oeuvre",* 205 pages, 5th Student Year, Printed Course INSA Rennes, 1997-2020.

A. GAVRUS – *"Matériaux Métalliques: Applications à la Mise en Forme. Modélisation du Comportement Elasto-Plastique par la Méthode des Eléments Finis sur FORGE2",* 30 pages, 5th Student Year, Printed Practical Works INSA Rennes, 2005-2016.

A. GAVRUS, H. FRANCILLETTE – *"Materiaux Non-Metalliques Ceramiques et Polymeres. Analyse et Selection Optimale sur FUZZYMAT",* 30 pages, 5th Student Year, Printed Practical Works INSA Rennes, 2001-2005.

A. GAVRUS – *"Matériaux Non-Métalliques: Applications à la Mise en Oeuvre. Analyse des Procedes et Selection Optimale des Matériaux sur FUZZYMAT"*, 3 pages, 5th Student Year, Printed Project INSA Rennes, 2010-2020.

A. GAVRUS – *"Travaux Pratiques de Mécanique des Milieux Continus",* 40 pages, 3th Student Year, Printed Practical Works INSA Rennes, 2002-2020.

A. GAVRUS – *"Thermodynamique des Milieux Continus en Grandes Déformations. Application à l'analyse d'un Essai de Compression Uniforme d'un Elastomere Incompressible Hyperelastique",* 12 pages, 3th Student Year, Printed Project INSA Rennes, 2012-2020.

A. LACHAL, **A. GAVRUS**, E. RAGNEAU – *"Introduction à la Mécanique des Milieux Continus Solides Déformables",* 30 pages, 2nd Student Year, Partial Printed Courses & Applications INSA Rennes, 2006-2013.

D. GUINES, I. THIBON, **A. GAVRUS**, H. FRANCILLETTE – *"Travaux Pratiques Matériaux*", 30 pages, 4th Student Year, Printed Practical Works INSA Rennes, 2001-2004.

A. GAVRUS – *"Travaux Pratiques Vibrations",* 25 pages, 4th Student Year, Printed Practical Works INSA Rennes, 1998-2001.

A. GAVRUS – *"Modélisation Numérique par la Méthode des Elements Finis. Applications sur Castem2000"*, 23 pages, 4th Student Year, Printed Practical Works INSA Rennes, 1998-2001.

Industrial & Research Contracts

1997-1998 *"Conception d'Outillage de Transformation des Matériaux Polymériques",* **Member Research Contract** N° 530, PCI Citroën Rennes (France) – LMS/INSA Rennes (France).

1997-1998 *"Calcul d'une ligne de vie en sollicitation dynamique",* **Member Research Contrat** N° 568, ABS St. Malo (France) – LMS/INSA Rennes.

2001-2003 *"Formulation et identification des lois de comportement pour des matériaux métalliques en grandes déformations"*, **Member Research Contract** N° 648, GEVELOT Extrusion Laval (France) - MA2G/INSA Rennes (France).

2003-2004 *"Détermination des conditions de formage à chaud de panneaux raidis soudés"*, **Member Research Contract** N° 3020, AIRBUS St. Nazaire (France), MA2G/INSA Rennes (France).

2009-2010 *"Etude Numérique et Expérimentale de l'Effort de Forgeage lors d'Opérations d'Ecrasement",* **Director Partnership Agreement** GEVELOT Extrusion Laval (France) – GMA/INSA Rennes (France).

2009-2010 *"Etude d'une Relation entre l'Ecrouissage et la Dureté d'une Pièce Forgée à Froid",* **Director Partnership Agreement** GEVELOT Extrusion Laval (France) – GMA/INSA Rennes (France).

2010-2011 *"Etude des concentrations de contraintes liées au forgeage par le couplage entre le procédé de déformation plastique et les phénomènes de relaxation de contraintes",* **Director Partnership Agreement** GEVELOT Extrusion Laval (France) – GMA/INSA Rennes (France).

2010-2011 *"Identification de la divergence de l'effort de forgeage entre la courbe expérimentale et celle obtenue par la simulation pendant un procédé de forgeage type écrasement. Etude de la prédiction Effort Presse/Simulation sur FORGE2",* **Director Partnership Agreement** GEVELOT Extrusion Laval – GMA/INSA Rennes (France).

2012 *"Diminution du risque du flambage en élasticité et pour des grandes déformations plastiques des pièces en acier et des outils lors des opérations de forgeage. Etudes Théoriques et Approches Numériques",* **Director Research Contract** GEVELOT Extrusion Laval (France) – LGCGM/INSA Rennes (France).

2012-2013 *"Etudes expérimentales et numériques de l'influence des paramètres rhéologiques du comportement des aciers d'outillage de forge (type 16MnCr5) sur le fibrage obtenu lors des écrasements par la frappe des lopins cylindriques",* **Director Partnership Agreement** GEVELOT Extrusion Laval (France) – GMA/INSA Rennes (France).

2012-2013 *"Conception et réalisation d'un dispositif mécanique pour lunettes vidéo",* **Director Partnership Agreement** OPTINVENT Rennes (France) – GMA/INSA Rennes (France).

2016-2017 *"Conception et optimisation d'une éolienne innovante",* **Director Partnership Agreement** AIRCRAFTED Paris (France) – GMA/INSA Rennes (France).

2016-2017 *"Analyses Théoriques, Etudes Numériques CFD et Validation Expérimentale en vue d'Optimisation des Performances Aérodynamiques et Energétiques d'un Rotor Eolien Innovant RoDaVi",* **Director Research Contract** AIRCRAFTED Paris (France) – LGCGM (EA3913) INSA Rennes/UFR Mathematics of UR1 (France).

2018-2019 *"Développement d'outils numériques dédiés à la conception et l'optimisation de joints élastomères"* **Director Partnership Agreement** TECHNETICS – CEA/Maestral Lab. Pierrelete (France) – LGCGM (EA3913) INSA Rennes

2019-2020 "Mise en place d'une modélisation numérique d'un banc d'essai au choc utilisé pour la qualification de produits spatiaux" **Director Partnership Agreement** SODERN ARIANE GROUP Paris (France) – GMA/INSA Rennes (France).

2020-2021 *"Etudes expérimentales et numériques du comportement des mousses métalliques avec applications dans la fabrication des absorbeurs de choc",* Research Responsible, by exchanges with BLAST SOLUTIONS - BS&A, Vitry-sur-Seine, Paris (France).

International Bilateral Academic Research Agreements

2006-2012 "*Etude et modélisation des procédés de mise en forme et d'usinage des matériaux métalliques et bio-matériaux. Applications à l'analyse du comportement des matériaux pendant des sollicitations sévères de déformation",* **French Coordinator** of the Bilateral Research Agreement INSA Rennes (France) – Univ. Dunarea de Jos de Galati – UDJG, Laboratoire ITCM de la Faculté de Mécanique (Romania).

2008-2013 *" Analyse des technologies modernes de déformation plastique (formage incrémental, formage discret, etc.) et identification des lois d'écoulement plastique et du frottement par analyse inverse",* **French Coordinator** of the Bilateral Research Agreement INSA Rennes (France) – Univ. Lucian Blaga Sibiu – ULBS, Laboratoire CSCDP de la Faculté d'Ingénierie Mécanique (Romania).

2010-2015 *" Modélisation du comportement physique, mécanique et tribologique des matériaux (métalliques, polymériques et/ou bio-matériaux) en conditions non-conventionnelles et soumises aux sollicitations extrêmes. Etudes numériques, développement des techniques d'analyse inverse et applications aux procédés de transformation innovants (usinage à grande vitesse, forgeage par impact, formage incrémental, etc.) "*, **French Coordinator** of the Framework Research Agreement INSA Rennes (France) – Univ. Dunarea de Jos de Galati – UDJG, Faculté de Mécanique et Faculté des Sciences (Romania).

2013-2018 Scientific Research and Teaching Bilateral Cooperation concerning « *New trends of engineering in mechanics, automatic, mechatronics and materials fields*», **French Responsible** of the Framework Agreement between INSA Rennes (France) – Univ. Politehnica de Bucarest, Facultés FIMM, FILS, FIMST, OMTR Laboratory (Romania).

2016-2020 Scientific Research and Teaching Bilateral Cooperation concerning « *Novel engineering techniques* », **French Responsible** of the Framework Agreement between INSA Rennes (France) – l'Univ. Yahia Farès de Medea, Faculté Science et Technologie (Algeria).

International and National Research Projects

1995-1997 European Project COST 512 "*Modelling in Material Science and Processing Material",* France (CEMEF, Sophia Antipolis), Czech Republic (Brno Univ., Ostrava Univ.), Slovenia (Ljubliana Univ.), Swiss (Géneva); TMP/CEMEF **French Research Team Member**; work in the tasks concerning Rheological Laws Formulation and Identification Using a Finite Element Inverse Analysis Based on an Analytical Gauss-Newton Algorithm and Parameter Sensitivity Computation.

2004-2008 French National Network OPTIMUS Project "*High Speed Machining"*, (INSA Rennes, ECN Nantes, UBS Lorient, Univ. Bordeaux, Univ. Lyon, CEMEF - ENSMP Sophia Antipolis, ENSAM Centers of ARTS & METIERS Paris Tech, France); LGCGM/INSA Rennes (France) **Research Team Member**; work in the field concerning Finite Element Simulation of High Speed Machining Using New Mesoscopic Metallic Rheological Constitutive Laws Based on Physical Mechanisms of Severe Loadings and Parameter Identification by Finite Element Inverse Analysis of Quasi-Stati & Dynamic Compression Tests.

From 2001 Breizh Regional Research Group BRESMAT "*Materials Mechanics"* (INSA Rennes, UR1 Rennes, ENS Cachan-Rennes, UBS Lorient, ENSIETA – ENSTA Brest); LGCGM/INSA Rennes (France) **Research Team Member**; work in the fields concerning Formulation & Identification of Physically Based Mesoscopic Materials Rheological Laws for Severe Loadings, Finite Element Modelling of Rapid Compression & Tensile Tests (SHPB, Dynamic Hydraulic Press Upsetting) and Application of Inverse Analysis Principle to Solve Inverse Problems (Boundary Conditions Identification, Numerical Calibration and Two-Step Parameter Identification) using Complete and Reduced Numerical Finite Element Models; Application of Inverse Analysis Principle to New Materials Forming Tribological Tests; New Trends of Experimental & Numerical Studies of Anisotropic Rheological and Tribological Behaviour.

2019-2020 Post-Doctoral Scientific Research Project INSA Rennes - University of Brittany Loire (UBL) – Breizh Region (USIAERO) *" Multi-physics/multi-scale analysis and numerical modeling of aeronautical metal alloys machining taking into account high thermomechanical gradients via behavior-damage-microstructure coupling"*, (62k€HT) LGCGM - Civil and Mechanical Engineering Laboratory (EA 3913) of INSA Rennes – Industrial Department of UBL **Scientific Research Supervisor** with project focus on the multi-physics and multi-scale modeling on machining of metallic materials with different crystallographic structures. The important challenge of the proposed numerical modeling project is to understand how the cutting conditions affect the local formation of the shear band and especially to predict the microstructure on the material surface. Physical modeling of material behavior plays a key role in the proposed approach. It is well known that the analytical methods has some limits, because it does not make it possible to include the complex thermomechanical behavior of the machined material and reliable tool / work contact interfaces laws. Numerical modeling, often using finite element method, makes possible to introduce complex thermo-mechanical behaviors, and to predict physical variables difficult to be obtained by experimental means. The used constitutive material behavior model must reproduce the sensitivity to high plastic deformation, deformation rate and temperature together with damage estimation. Microstructure evolution induced by the cut and the local gradients of the thermomechanical variables requires improvements of specific modelling methods. Specific strategy based on multi-scale and multi-physics modelling must be adopted to obtain plastic deformation / damage coupling, plastic deformation / microstructure coupling.