

# MARC MASSOT

## PROFESSOR ECOLE POLYTECHNIQUE

### CENTRE DE MATHÉMATIQUES APPLIQUÉES

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Married, 2 children

## EDUCATION – WORK EXPERIENCE

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- 2014 - ADJUNCT SCIENTIST AT MAISON de la SIMULATION, Saclay
- 2013 - SCIENTIFIC CONSULTANT AT ONERA, Solid and Liquid Propulsion divisions, Palaiseau
- 2013 - 2016 CHAIRMAN OF THE FÉDÉRATION DE MATHÉMATIQUES DE L'ÉCOLE CENTRALE PARIS - FR CNRS 3487 of INSMI gathering all mathematicians of CentraleSupélec in three laboratories MAS, MSSMAT et EM2C. The Fédération has been associated with Fondation Mathématique Jacques Hadamard and Labex Mathématique Hadamard in 2015.
- 2011 - 2012 VISITING PROFESSOR FOR ONE YEAR AT THE CENTER FOR TURBULENCE RESEARCH - STANFORD UNIVERSITY, with a Senior Fellowship from Stanford University - PI of the Collaboration grant of the France-Stanford Center for Interdisciplinary Studies
- 2011 - 2016 FULL PROFESSOR AT ÉCOLE CENTRALE PARIS - Awarded the PES and PEDR in 2011-2019 (Scientific Excellence Award)
- 2010 - 2016 DEPUTY DIRECTOR OF THE COMPUTING CENTER at Ecole Centrale Paris (Mésocentre), extended in 2015 to CentraleSupélec and ENS Cachan - CPER Grant from région Ile de France
- 2008 - 2010 NATIONAL RESPONSABILITY AT CNRS for the coordination of scientific computing at the level of France - INSMI (National Institute for Mathematics and their Interaction - Chargé de mission)
- 2005 - 2011 ASSOCIATE PROFESSOR AT ÉCOLE CENTRALE PARIS of Fluid Mechanics and Applied Mathematics, Research in the Laboratory EM2C. ANR Young Investigator Award.
- 2003 HABILITATION À DIRIGER DES RECHERCHES of University Claude Bernard, Lyon 1, *Mathematical Modeling of Reactive Media : mathematical analysis, numerical analysis and scientific computing*, defended in 2003 - Referees : S. Candel, C. Dafermos, S. Luckhaus and B. Perthame
- 1997 - 2004 CHARGÉ DE RECHERCHE AT CNRS (Associate Researcher with tenure) at the Laboratory of Applied Mathematics of Lyon, MAPLY - UMR CNRS 5585, University Claude Bernard Lyon 1. Young Investigator Award from CNRS. Chargé de Recherche de 1ère Classe since October 2001
- 1996 - 1997 POSTDOCTORAL POSITION at the Center for Combustion Studies, Department of Mechanical Engineering, YALE UNIVERSITY. "Mathematical and numerical modeling of polydisperse spray combustion". Collaboration with M.D. Smooke and A. Gomez
- 1993 - 1996 Ph.D. THESIS, ECOLE POLYTECHNIQUE in APPLIED MATHEMATICS : *Mathematical and numerical modeling of multicomponent reactive flows*, prepared at the Center for Applied Mathematics with a grant from C.N.R.S. / Ministry of Defense. Advisor : Vincent Giovangigli. Defended September 10th, 1996 - Referees : V. Volpert and T. Poinso
- 1992 - 1993 MASTER THESIS IN NONLINEAR AND NUMERICAL ANALYSIS, Ecole Polytechnique–Paris VI, with High Honors (Mention Très Bien)
- 1989 - 1992 GRADUATED from ECOLE POLYTECHNIQUE, Studies based on general scientific education, mathematics, physics, chemistry, mechanics, economy and cognitive science. Majors in mathematics, applied mathematics and scientific computing

## PRINCIPAL RESEARCH THEMES

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### MATHEMATICAL MODELING:

- Multicomponent reacting flows with complex chemistry and detailed transport, derivation of the system of conservation equations from kinetic theory, entropic symmetrization in relation with its multi-scale character.
- Extension to the fluid modeling of weakly ionized multicomponent plasma flows out of thermal and chemical equilibrium, as well as strongly magnetized plasma flows. Unification of the existing theories in connection with thermodynamics consistency and Onsager reciprocal relations. Application to solar physics modeling.
- Eulerian modeling of polydisperse evaporating liquid sprays in combustion chambers in the framework of automotive, aeronautical and solid propulsion. Extension to moderately dense liquid sprays involving coalescence and secondary break-up, to turbulent flows in the RANS and LES framework and to strongly two-way coupled configurations.
- High order moment methods for the description of droplet/particle size distributions dynamics in phase space, quadrature method of moments, realizability condition and transport in physical space. High order moment methods in velocity phase space, Levermore hierarchy, maximization of entropy and multi-gaussian closures in order to capture particle trajectory crossing.
- Methods of reduction of complex chemical mechanisms based on thermochemistry, singular perturbation analysis in the framework of partial equilibrium assumption and application to compressible reacting flows using entropic symmetrization.
- Modeling of natural convection, justification of the Oberbeck-Boussinesq limit. Influence of natural convection on the thermal explosion limits. Simplified nonlinear models describing the principal bifurcations of the system. Analysis of the coupling of radiative transfert / particle dynamics / natural convection and its influence on the creation of turbulence.

### MATHEMATICAL ANALYSIS:

- Cauchy problem and theory of existence and uniqueness of solutions for mixed hyperbolic-parabolic systems of equations with an entropic structure, asymptotic stability of equilibrium states and rates of convergence.
- Symmetrization of mixed hyperbolic-parabolic systems of equations with source terms, normal form theory in the sense of Kawashima.
- Global singular perturbation theory for finite and infinite dimension dynamical systems with an entropic structure.
- Existence and stability of mono-dimensional travelling waves modeling the propagation of gaseous flames in the limit of zero mass diffusion and for two-phase spray flames.
- Analysis of entropic solution of weakly hyperbolic systems of equation such as the pressureless gas dynamics and the quadrature method of moment hierarchy and their behavior at the boundary of the moment space.

### NUMERICAL ANALYSIS:

- Analysis of the multi-fluid methods for the description of singular transport in phase space, development of high order moment methods and their analysis.
- Error analysis of operator splitting methods in the non-asymptotic regime in the presence of fast scales, order reduction characterization and development of adaptive splitting methods based on a posteriori error estimate. Development of a global numerical strategy coupled to a finite volume method with adaptive multiresolution in space based on wavelets leading to error control with adaptation in space and time in any dimension for reaction-diffusion and convection-reaction-diffusion systems, potentially coupled to a Poisson equation.
- Characterization of the influence of stiffness and fast scales in the convergence of the parareal algorithm (parallel in time algorithm) for PDEs.

- Developpement of high order kinetic schemes describing the transport in phase space and physical space of high order moment methods with a link with the underlying algebra and computational algebra.
- Extension of relaxation schemes for the description of various asymptotic limits of the Euler equations describing particle-laden flows: zero density limit, zero pressure limit and zero inertia limit in the presence of unresolved scales leading to asymptotic preserving schemes.

#### SCIENTIFIC COMPUTING, HIGH PERFORMANCE COMPUTING:

- Simulation of laminar two-phase flows and reacting two-phase flows in 2D and 2D-axisymmetrical configurations for the purpose of quantitative comparisons with experimental measurements. Direct numerical simulation and large eddy simulation of tridimensional turbulent two-phase and reacting two-phase flows. Detailed verification of the modeling and numerical methods through comparisons with Lagrangian simulations of such flows. Development of new numerical methods and their implementation on massively parallel architectures and new generations and out of architectures.
- Direct numerical simulation of very stiff plasma flow models and application to plasma discharges, as well as out of thermal and chemical equilibrium plasma flows in strongly magnetized environment in relation with magnetic reconnection in solar physics.
- Efficient simulation of stiff reaction fronts in time and space based on operator splitting with application to nonlinear chemical dynamics, flame dynamics and the dynamics of depolarization waves in the modeling of strokes in biomedical engineering. Extension to the case of complex chemistry and detailed transport and to the limit of low Mach numbers.
- Combinatorial enumeration of the symmetries of branched paraffins in oil hydrocracking for the prediction of thermodynamics properties relying on graph theory and generating functions (Pòlya's theorem).

#### CODES

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- 2006 - 2016 MUSES3D code for the resolution of Eulerian models for polydisperse evaporating sprays in laminar and turbulent gaseous flows coupled to the ASDPHODELE code solving Navier-Stokes equations for multicomponent reacting flows in the low Mach number limit developed by J. Réveillon at CORIA. The code scales up to 8000 cores (GENCI - CINES) and is used in several teams and laboratories. Originally developed in the framework of the PhD Thesis of S. de Chaisemartin.
- 2008 - 2016 MBARETE code solving for reaction-diffusion and reaction-convection-diffusion systems of PDEs eventually coupled to a Poisson solver (plasma - low mach number combustion) with adaptation in space and time and error control based on time adaptive operator splitting, wavelet-based adaptive multiresolution in space. Applications to nonlinear chemical dynamics, biomedical engineering (simulation of ischemic strokes), combustion and plasma discharges. Originally developed in the framework of the PhD Thesis of M. Duarte and optimized for shared-memory architectures. An implementation of the methods with a new data structure has been conducted on Xeon Phi INTEL multi-core architecture with an efficiency of 2.
- 2013 - 2016 CanoP code for the resolution of convection-reaction systems of PDEs with cell-based AMR relying on the massively parallel p4est library leading to a very nice scaling. Application to separated phase two-phase flow resolution based on diffuse interface models. Originally developed in the framework of the PhD Theses of F. Drui and M. Essadki based on a collaboration between EM2C Lab, Maison de la Simulation and IFPEN.

## RESPONSIBILITIES

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### MAIN ACCOMPLISHMENTS:

- 2010 - Initiation of a project of structuration of the mathematics community at Ecole Centrale Paris in order to involve CNRS and INSMI (Institut des Sciences Mathématiques et leurs Interactions - National Institute for Mathematics and their interactions). Creation of the “Fédération de Recherche” CNRS gathering all the mathematicians in several laboratories EM2C (UPR CNRS), MSSMAT (UMR CNRS) and MAS (EA) with the support of CNRS/INSMI and the direction of Ecole Centrale Paris. The objective has been to identify the mathematics community at Ecole Centrale Paris, while preserving the very interdisciplinary projects present involving mathematicians in the various laboratories. The project of Fédération was written in collaboration with Erick Herbin and presented to CNRS in January 2012. The Mathematics unit of Ecole Centrale Paris, called “Fédération de Mathématiques de l’Ecole Centrale Paris - FR CNRS 3487” was created in January 2013, thus creating the identity of Mathematics at ECP (Chair M. Massot). It allows the recruitment of CNRS researchers and has been evaluated very positively by AERES in January 2014 and associated with FMJH (Fondation Mathématique Jacques Hadamard) and LMH (Laboratoire d’Excellence - Labex - Mathématique Hadamard), which represent the excellence of mathematics at the scale of Université Paris-Saclay, in 2015.
- 2009 - Initiator of the project of a mesoscale computing center (mésocentre in French) gathering all the laboratories of the research center of Ecole Centrale Paris in 2009. Co-responsible of the creation of the project (budget 500kEuros), recruitment of a high level software engineer (L. Séries) and acquisition of the first computer with Damien Durville and the mésocentre’s team in 2010. Strong involvement in the recruitment of L. Séries. Presentation of the mésocentre, Septembre 21st 2010 and 2012 at the national mésocentre days co-organized by groupe CALCUL, CPU and GENCI - videos available : <http://calcul.math.cnrs.fr/spip.php?article149> - <http://mesogrilles2012.sciencesconf.org/resource/page/id/12>. Initiation of a seminar of the mésocentre. Strong involvement in the extension of the mésocentre to CentraleSupélec and ENS Cachan and in the writing of the proposal for a CPER financial support, which has been accepted (2015-2021- 3 million euros). The link has been established with the Mathematics Department of Paris-Saclay University and the Working Group “Simulation and modeling, high performance computing” of Université Paris-Saclay.
- 2005 - Following the invitation of S. Candel, creation and responsibility of a mathematics team in an Engineering Laboratory. Starting from a Professor and a CNRS researcher in 2005, the team has evolved into a team of five scientists, one professor, one software engineer, one assistant professor and two CNRS researchers, all tenured. This team has evolved into one of the four main axes of research of the laboratory EM2C, as acknowledged by the AERES evaluation in 2014 of both the EM2C Laboratory and of the Fédération de Mathématiques de l’Ecole Centrale Paris. Several breakthrough research accomplishments have been conducted in the framework of this originally positioned team and recognized as such in the scientific community (see the article M. Boileau, A. Larat, F. Laurent-Nègre, and M. Massot. *Une équipe de mathématiques dans un laboratoire d’ingénierie ou comment tenter de repousser les limites de l’interaction des mathématiques sans y perdre son identité*, Matapli, 101 :125138, Juin 2013. Article de prospective invité pour le Numéro Spécial pour les 30 ans de la SMAI).

### GRANTS - SCIENTIFIC PROJECT:

- 2016 - 2019 Labex LMH and LASIPS Projet NEMESIS, *NowElles METHodes adaptatives pour la SIMulation de la dynamique de fronts en combustion and physique des plasmas with contrôle de préciSion*, PI. M. Massot in collaboration with LIMSI, Orsay, CMAP and LPP Ecole Polytechnique on adaptive methods in space and time with error control for the simulation of combustion waves and plasma waves. 120 kEuros.

- 2014 - 2018 ANR Blanc project **NEXTFLAME**, *Numerical and Experimental Two-phase Flame*, PI. M. Boileau and M. Massot in collaboration with CERFACS (experimental and numerical two-phase combustion DNS and LES). 550 kEuros
- 2014 - 2018 Participation in ANR Blanc project **TIMBER**, PI. R. Vicquelin and ANR TDM **ASMAPE**, *Advanced modeling of soots for aeronautical and automotive engines*, PI O. Colin, IFPEen on Eulerian moment models and numerical methods for spray and soot particles. Collaboration with SAFRAN Snecma, IFPEen, PCA, PC2A, CORIA
- 2012 - 2013 Participation in the project of the LASIPS Labex: PROCID, “Processing tools for characterization and low-order model identification of dynamic flows”, coordinated by Franck Richecoeur, EM2C, in collaboration with LadHyX, P. Schmid, Ecole Polytechnique, and LIMSI, Orsay. 70 kEuros
- 2010 - 2013 Coordinator of the DIGITEO project **MUSE : MULTISCALE SPRAY COMBUSTION FULLY EULERIAN SOLVER IN 3D : A NEW GENERATION OF NUMERICAL METHODS AND ALGORITHMS, HIGH PERFORMANCE SIMULATIONS, VALIDATION AND VISUALIZATION**, DIM LSC, Modeling and Simulation in collaboration with LMO (B. Graille) and LIMSI (C. Tenaud) at Orsay University, 226 kEuros
- 2009 - 2013 Participation in the ANR Blanc projet *Séchelles : Simulations and comparisons with experiences for the validation of models of multi-scale problems* (Award from the French national research agency : ANR, interdisciplinary between Mathematics and Engineering), and coordinator of the EM2C Laboratory participation; PI of the project Professor S. Descombes, University of Nice. EM2C : 290 kEuros
- 2009 - 2010 Participation in the PEPS projet *MIPAC : Algorithmique parallèle and ordonnancement appliqués à la combustion en chimie complexe sur architecture Blue Gene* (Projet Exploratoires Pluridisciplinaires - Maths-ST2I, interdisciplinary between Mathematics and Computer Science); PI of the project V. Louvet, Institut Camille Jordan, Université de Lyon. 8 kEuros
- 2007 - 2010 Participation in the ANR Intensive Scientific Computing PITAC (Parallelization Including Time in order to accelerate computations) and coordinator of the EM2C Laboratory participation; PI of the project Professor Y. Maday, Paris VI. Collaboration with S. Descombes, Laboratoire Dieudonné, Université de Nice and S. Volz, Laboratoire EM2C, ECP. EM2C : 100 kEuros
- 2006 - 2009 Coordinator of the project **JÉDYS : jeune équipe Dynamique des Sprays en évaporation and en combustion (Young Investigator Award from the French national research agency : ANR), APPEL À PROJETS JEUNES CHERCHEURS DE L'ANR** in the two committees Engineering Sciences and Mathematics and Interactions of Mathematics. 130 kEuros
- 2006 - 2010 Task : “Operational evaluation of Euler versus Lagrange formulation for polydisperse evaporating sprays” in the European project TIMECOP-AE “Toward Innovative Methods for Combustion Prediction in Aeronautic Engines”. Scientific coordinators of the task: M. Massot and J. Réveillon CORIA-Rouen; coordination of the project by SNECMA/Turbomeca (6 industrial partners and 15 academic institutions). 50 kEuros.
- 2003 - 2005 Scientific coordinator of the project “Eulerian multi-fluid models for the large eddy simulations of polydisperse two-phase combustion” at the fourth call for project of the RRIT (Réseau de Recherche and d’Innovation Technologique) **RECHERCHE AÉRONAUTIQUE SUR LE SUPERSONIQUE**, Ministry of Research. Collaboration between MAPLY - UMR 5585, CORIA - UMR 6614 and LMFA - UMR 5509. 70 kEuros
- 2003 - 2006 Co-responsible of the **ACI NOUVELLES INTERFACES DES MATHÉMATIQUES** project “Modeling of reactive media : toward new simulation tools for multi-scale problems” with S. Descombes, UMPA, UMR 5669 - ENS Lyon, Ministry of Research. 30 kEuros
- 2004 Research contract with the company SME/SNPE coordination on the modeling and simulation of the coupling between natural convection and thermal explosion in energetic material containers in collaboration with T. Dumont and V. Louvet (9 months - 25 kEuros).
- 2001 - 2003 Scientific coordinator of the project “Modeling of the coupling between droplet dynamics and fuel mass fraction topology in polydisperse two-phase combustion” at the fourth call for project of the

RRIT (Réseau de Recherche and d'Innovation Technologique) **RECHERCHE AÉRONAUTIQUE SUR LE SUPERSONIQUE**, Ministry of Research. Collaboration between MAPLY - UMR 5585, CORIA - UMR 6614 and LMFA - UMR 5509. 746 kF

- 2001 - 2002 Principal investigator of the **ABONDEMENT ANVAR** : “Modeling of reactive media : Interaction of Mathematics with Biology, Chemistry and Physics”, 36 kEuros
- 2001 - 2002 Scientific coordinator of the “High quality research grant” from Université Claude Bernard, Lyon 1, 120 kF : “Modeling of reactive media : Interaction of Mathematics with Biology, Chemistry and Physics”, (scientific responsibility : S. Génieys M. Massot and V. Volpert)
- 1999 - 2001 One of the two recipient of a **YOUNG INVESTIGATOR AWARD** with V. Volpert : “Mathematical and numerical modeling of reactive media”, 100kF HT
- 1998 - 1999 Scientific coordinator of the “High quality research grant” from two institutions Université Claude Bernard, Lyon 1 and Ecole Centrale de Lyon, 210kF HT, “Mathematical and numerical modeling of reactive media”, with V. Volpert, M. Marion (MAPLY - UMR 5585 : 130 kF) and D. Escudé (LMFA - UMR 5509 : 80 kF)
- 1997 - 1998 High quality research grant from the Université Claude Bernard, Lyon 1, “Mathematical modeling of reactive media”, 100kF HT (co-responsible with V. Volpert)

#### **ADVISORSHIP:**

- 2015 - 2018 **Ph. D. THESIS** of David Mercier, (co-advised with A. Larat and A. Vié) with a Ph.D. grant from DGA and support from SAFRAN Tech) : *Large Eddy Simulation of polydisperse sprays in turbulent flows in the framework of strong two-way coupling*
- 2015 - 2016 **MASTER THESIS AND TRAINEE** of Quentin Wagnier (7 months and then 9 months) with B. Graille (LMO/Orsay), T. Magin (VKI/Bruxelles) and N.N. Mansour (NASA Ames) on the fluid modeling of strongly magnetized plasma flows out of thermal and chemical equilibrium. Obtained a PhD grant 2016-2019 from IDI 2016 of IDEX Paris-Saclay.
- 2014 - 2016 Post-doctoral fellowship of two years in the framework of ANR project ASMAPE of Tan-Trung Nguyen “Eulerian methods for the description of soot: mathematical modeling and numerical scheme”, co-advised with Frédérique Laurent-Nègre.
- 2014 - 2017 **Ph. D. THESIS** of Mohamed Essadki, (co-advised with S. De Chaisemartin, S. Jay and F. Laurent) with a Ph.D. grant from IFPE) : *Contribution to the unified Eulerian modeling of liquid jet : from the dense core to the disperse phase*
- 2014 - 2017 **Ph. D. THESIS** of Valentin Dupif, (co-advised with J. Dupays and F. Laurent) with a Ph.D. grant from ONERA) : *Eulerian modeling and simulation of two-phase flows in solid rocket motors taking into account polydispersity and droplet trajectory crossing.*
- 2014 - 2016 Post-doctoral fellowship of two years in the framework of ANR project NEXTFLAME for Jorge César Brändle de Motta “Direct numerical simulations of two-phase flames and comparison with experimental measurements”, co-advised with Matthieu Boileau. J.C. Brändle de Motta has been recruited as Assistant Professor in Université de Rouen, CORIA in 2015.
- 2013 - 2016 **Ph. D. THESIS** of Florence Drui, (co-advised with S. Kokh, A. Larat) with a Ph.D. grant from DGA/CEA) : *A unified Eulerian modeling for the injection and atomization process of liquid fuel in automotive and aeronautical engines*
- 2012 - 2013 Post-doctoral fellowship of two years in the framework of ANR Séchelles and ECP for Vincent le Chenadec “Eulerian modeling of separated phases two-phase flows and small scale dissipative structures” and in the framework of project PROCID of Taraneh Sayadi “Extension of DMD for the analysis of experimental data and bifurcation analysis, and analysis of particle trajectory crossing in two-phase flows and related dynamical system issues” with Peter Schmid Ladhyx, Ecole Polytechnique, F. Richecoeur and A. Vié at EM2C. V. Le Chenadec and T. Sayadi have been recruited as Assistant Professor in UIUC, USA.

- 2012 - 2015 Master Thesis and **Ph. D. THESIS** of Macole Sabat, (co-advised with A. Larat and F. Laurent) with a Ph.D. grant from the Ministry of Education) : *Modeling and numerical methods for the accurate description of turbulent and polydisperse evaporating sprays*, with a support from SAFRAN group
- 2011 - 2014 Master Thesis and **Ph. D. THESIS** of Alaric Sibra, (co-advised with F.Laurent and J. Dupays (ONERA)) : *Modeling and numerical simulation of aluminium spray evaporation and combustion in solid propulsion using Eulerian multi-fluid models*, with a Grant from ONERA (the French Aerospace Lab). A. Sibra has been recruited as Engineer by Airbus Space&Defense in September 2014. Best Thesis prize of ONERA, MFE Branch in 2014.
- 2010 - 2014 **Ph. D. THESIS** of Oguz Emre, (co-advised with F.Laurent, S. De Chaisemartin and S. Jay (IFPEn)) : *Modeling and numerical methods for treating polydispersion and strong coupling for disperse to dense two-phase flows*, with a Grant from IFPEn. O. Emre has been recruited as Engineer by LMS, Siemens in 2014.
- 2010 - 2014 Post-doctoral fellowship of two years in the framework of DIGITEO Project for Aymeric Vié “Polydisperse spray Eulerian multi-fluid modeling and a new generation of models and numerical methods for Large Eddy Simulations” at laboratory EM2C in collaboration with A. Larat, F. Laurent, R.O. Fox and M. Boileau, and co-advisor of his postdoctoral stay supported by SAFRAN at the Center for Turbulence Research, Stanford University in collaboration with CERFACS and SAFRAN-TurboMéca. A. Vié has been recruited as Assistant Professor in CentraleSupélec.
- 2010 - 2011 Post-doctoral fellowship of one year for Amélie Danlos (“Laser diagnostics and analysis of two-phase flow dynamics”) in the framework of DIGITEO project in collaboration with F. Richecoeur and L. Zimmer. A. Danlos has been recruited as Assistant Professor in CNAM.
- 2009 - 2013 Master Thesis and **Ph. D. THESIS** of François Doisneau, (co-advised with F.Laurent and J. Dupays) : *Modeling and numerical simulation of polydisperse diphasic flows coming from the combustion of solid propellers loaded with nanometric particles*, with a Grant from DGA. Collaboration with ONERA (the French Aerospace Lab defended April 11th 2013. Presently Post-doctoral fellow at CRF, Sandia National Laboratory, Livermore.
- 2008 - 2011 Master Thesis and **Ph. D. THESIS** of Max Duarte, (co-advised with F. Laurent and S. Descombes) : *Adaptive numerical methods for the simulation of multi-scale reacting waves*, with a Grant from CNRS, BDI from two Institutes of CNRS, Engineering and Mathematics in connection with the DIGITEO Project MUSE lead by M. Massot. Ph.D Defended on the 8th of December 2011. **The PhD has received the Award of the best Thesis of the GAMNI/SMAI in France in 2012 as well as the Award for the best ECCOMAS Ph.D. Thesis at the European level in the field of “Computational Methods in Applied Sciences and Engineering”. After a Postdoctoral stay of two year at Lawrence Berkeley National Laboratory and one year at Yale University, he has been recruited as Research Engineer at CD-Adapco in 2015.**
- 2007 - 2008 Post-doctoral fellowship of two years in the framework of ANR-CIS project PITAC for C. Audouze, Laboratoire EM2C, UPR CNRS 288 in collaboration with S. Volz (Laboratoire EM2C) and S. Descombes (Université de Nice). C. Audouze has been recruited as Software Engineer at LSS, Supélec and moved to a Research Associate position, University of Toronto Institute for Aerospace Studies.
- 2007 - 2008 Post-doctoral fellowship of two years in the framework of the project ANR Jeunes Chercheurs jéDYS for Lucie Fréret and Corine Lacour, Laboratoire EM2C. Corine Lacour has been recruited as Assistant Professor in September 2009 at CORIA, and Lucie Fréret has been recruited as CNRS Software Engineer at Paris VI, LIP.
- 2007 - 2010 Master Thesis and **Ph. D. THESIS** of Damien Kah, with F. Laurent-Nègre, S. Jay (IFP) and S. Candel (EM2C) : *Taking into account polydispersity in the simulation of spray injection in automotive engines*, CIFRE grant at IFP Energies nouvelles, Collaboration with R.O. Fox, Iowa State University, U.S.A. - Defended December 20th 2010. **The PhD has received the Award of**

the best Thesis of the GAMNI/SMAI in France in 2011 as well as the Award for the best ECCOMAS Ph.D. Thesis at the European level in the field of “Computational Methods in Applied Sciences and Engineering”. After a postdoctoral stay at the Center for Turbulence Research, Stanford University as Research Associate, Damien Kah has been recruited as Flow Simulation Engineer at Western Digital, California.

- 2005 - 2008 **Ph. D. THESIS** of Stéphane de Chaisemartin with F. Laurent-Nègre : *Eulerian models and simulation of the turbulent dispersion of polydisperse evaporating sprays*, with a DGA/BDI grant from départements MPPU and ST2I of CNRS and with support of INCA project as well as European project TIMECOP-AE. Defended March 20th 2009. S. de Chaisemartin has been recruited as Research Engineer at IFPEN, Mathematics Department, April 2009.
- 2004 - 2007 **Ph. D. THESIS** of A. Guilbaud with P. Crépel (CNRS, ICJ, Université Claude Bernard Lyon 1): *L'hydrodynamique dans l'œuvre de D'Alembert 1766-1783 : histoire and analyse détaillée des concepts pour l'édition critique and commentée de ses Œuvres Complètes and leur édition électronique*, with a BDI CNRS grant from départements MPPU and SHS of CNRS. Defended December 7th 2007. A. Guilbaud has been recruited as Assistant Professor in Université Pierre and Marie Curie, Paris VI, Institut de Mathématiques de Jussieu in September 2009.
- 2002 - 2005 **Ph. D. THESIS** of G. Dufour with P. Villedieu, ONERA Toulouse : “Development of Eulerian multi-fluid models for the description of secondary break-up of polydisperse sprays”. Defended in December 2005. G. Dufour has been recruited as Research Engineer at ONERA - DTIM, July 2006.
- 2003 Master Thesis co-advised with P. Crépel (DEA: Construction des Savoirs Scientifiques : Didactique, Histoire and Epistémologie, Lyon) of A. Guilbaud, Université Claude Bernard Lyon 1, with a grant from CNRS : “Conservation des forces vives en mécanique des fluides au XVIIIe and XIXe siècles”, Septembre 2003. A. Guilbaud obtained the prize of the best Master Thesis memoir at a national scale from la Société Française d'Histoire des Sciences and des Techniques in 2004
- 2002 - 2003 Post-doctoral fellowship of one year in the framework of “Projet Supersonique” : Dr. Ronnie Knikker (in collaboration with J. Réveillon, CORIA UMR 6614, Rouen). R. Knikker has been recruited as Assistant Professor in CETHIL, INSA de Lyon in September 2003
- 2002 Post-doctoral fellowship of five month in the framework of Abondement ANVAR : Dr. Claire Bordes (with T. Dumont, MAPLY and I. Pitault, Laboratoire de Génie des Procédés Catalytiques, UMR 2214). C. Bordes has been recruited as Assistant Professor in Laboratoire de Chimimétrie de l'Université Claude Bernard Lyon 1, in September 2002
- 1999 - 2002 **PhD THESIS** of F. Laurent, Université Claude Bernard Lyon 1, with a grant “Docteur-Ingénieur” from CNRS : “Mathematical modeling and numerical simulation of two-phase combustion”. Defended September 2002. F. Laurent has been recruited Chargée de Recherche CNRS (section 01) at Laboratoire EM2C, UPR 288, Ecole Centrale de Paris in October 2003

#### **ANIMATION:**

- 2015 - Participation in the organization of the seminar series of the Working Group “Simulation and modeling, high performance computing” of Université Paris-Saclay
- 2011 - 2016 Participation in the organization of the Seminar of Fédération de Mathématiques de l'Ecole Centrale Paris and of the Mésocentre.
- 2004 - 2016 Participation in the organization of the Seminar of laboratory EM2C and of the working group “partial differential equations and numerical analysis”
- 2007 - 2010 Creation and organization of an interdisciplinary working group taking place every other month involving “Analyse numérique and calcul scientifique” Laboratoire EM2C, Institut Camille Jordan (T. Dumont, V. Louvet) and Laboratoire Dieudonné, Université de Nice (S. Descombes)



- 2002 - 2003 Participation in the organization of the Colloquium de Mathématiques at Laboratoire MAPLY - UMR 5585, Colloquium co-organized with the fundamental mathematics laboratory at Université Lyon 1 (IGD)
- 2003 Organization of the PSMN one-day workshop: “Résolution numérique de problèmes d'évolution: contraintes, invariants and relaxation” at ENS Lyon in collaboration with S. Descombes and J. Pousin
- 2001 - 2004 Co-responsible of the scientific axis of the laboratory MAPLY “Scientific Computing Numerical Analysis for multi-scale problems” Laboratoire de Mathématiques Appliquées de Lyon, with T. Dumont
- 2001 - 2002 Participation in the organization of “Séminaire du Laboratoire de Mathématiques Appliquées de Lyon” - UMR 5585 (in collaboration with E. Rouy and G. Bayada)
- 2001 Organization of the PSMN - GAMNI - ONERA one-day workshop: “Modélisation numérique de brouillards polydispersés” at ENS Lyon in collaboration with P. Villedieu and J-F. Maitre
- 2001 - 2004 Representative of Laboratoire MAPLY in the GDR EAPQ, E. Lombardi and GDR Interaction de particules, T. Goudon
- 2001 Organization of a **POST-GRADUATE LECTURE SERIES** in the framework of doctoral School “Mathématiques and Informatique Fondamentale de Lyon”, and of the group “Modélisation Mathématique des Milieux Réactifs”, one-week of courses by R. Témam, B. Perthame and G. Makhviladze, 5-14 Mars 2001
- 1998 - 1999 Organization of the (Budget 110 kF) du **INTERNATIONAL WORKSHOP “MODELING OF REACTION FRONTS : at the interface of Mathematics, Physics and Chemistry”**, 19-20-21 Avril 99, with V. Volpert and M. Marion
- 1998 - 2001 Creation and organization of the **WORKING GROUP “Mathematical modeling of reacting media”** at the Université Claude Bernard Lyon 1, 52 talks

**COMMITTEES, COMMISSIONS:**

- 2016 Chair of the selection committee for the Assistant Professor position at INSA de Rouen, “Modeling through PDEs, parallel computing, mathematical analysis (numerical analysis), mathematical analysis (PDEs)”
- 2015 Membre of the HCERES (national evaluation agency for laboratories) committee for the evaluation of CORIA at Rouen
- 2015 - Representative of the Mathematics Department of Université Paris-Saclay in the Working Group “Simulation and modeling, high performance computing”, setting up a strategy of the University with a transdisciplinary point of view - participation in writing the proposal to the AMI - IRS - CEPS project, which has passed the first selection (april 2016)
- 2014 Member of the Working Group Mathematics of the Mathematics Department of Université Paris-Saclay and coordination of a sub-Working Group “scientific computing” in the framework of the Working Group Mathematics of the Mathematics Department.
- 2014 - Member of the Administration Board of IDRIS nominated by the Ministry of Research.
- 2011 - 2012 Member of the Steering Committee of the Center for Turbulence Research, Stanford University
- 2012 Member of the organizing committee of CEMRACS 2012 (Centre d'Eté Mathématique de Recherche Avancée en Calcul Scientifique - méthodes numériques and algorithmes pour architectures hautes performances)
- 2011 Member of the task force created by CNRS in order to create a structure coordinating the issues related to scientific computing and high performance computing between the disciplinary institutes of the CNRS. Membre du COCIN.
- 2010 - 2016 Member of several selection committees for Assistant and Associate professor positions

- 2008 - 2016 Member of the office of GDR CALCUL of INSMI (National Mathematics Institute of CNRS), of the Steering Committee of Réseau Technologique CALCUL de la MRCT du CNRS and membre of the project GENCI-CPU-CALCUL for the creation of a network of mésocentres at a national scale.
- 2008 - 2010 Member of the office of ORAP organization promoting high performance computing.
- 2007 - 2008 Member of the scientific council of ANGD ENVOL (formation pour le développement and la Valorisation des Logiciels en environnement de recherche).
- 2007 - 2010 Member of the prospective committee of GdS Mathrice (GdS 2754)
- 2006 - 2009 Nominated member of the Laboratory council at EM2C - UPR CNRS 288
- 2002 - 2010 Nominated member representing CNRS at the “Comité National Français de Mathématiciens” (proposed by the Comité National, section 01)
- 2000 - 2004 Member of three selection committees (commissions de spécialistes) : Lyon 1 - 25ème section, CS Lyon 1 - 26ème section and CS ECL - 60ème and 62ème sections
- 1999 - 2004 Nominated member of the Laboratory council MAPLY - UMR 5585

## INTERNATIONAL COLLABORATIONS

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- 2016 One month stay in Tokyo in the framework of the ERASMUS MUNDUS EASED project, collaboration with Keio University (particle synthesis through combustion and spray combustion) and JAXA (turbulent two-phase flows).
- 2016 One week stay and invited seminar at SANDIA National Laboratories, Combustion Research Facility on the modeling and simulation of high two-way coupled two-phase flows and their application to fuel injection in automotive engines and solid propulsion.
- 2014 - 2016 Collaboration with the von Karman Institute and NASA Ames Research Center. Invitation to the first **NASA SUMMER PROGRAM**, on *Plasma Simulation and Modeling at NASA Ames Research Center* organized by N.N. Mansour. Student exchange and PhD proposal on strongly magnetized plasmas, fluid models and their simulation with application to solar atmosphere and magnetic reconnection.
- 2015 Invitation to a plenary Lecture at the *47th Fluid Dynamics Conference / 33rd Aerospace Numerical Simulation Symposium* and to a 10 day stay at JAXA, Tokyo, to initiate a collaboration on the modeling of turbulent two-phase flows.
- 2011 - 2012 PI of the France-Stanford interdisciplinary collaboration grant with P. Moin, *Center for Turbulence Research, Stanford University*, (France-Stanford Center for Interdisciplinary Studies - \$14,000 of travel money) on “Multi-scale mathematical modeling and numerical methods for multiphase and reactive flows”
- 2010 Projects and related fellowships for the ‘Summer Program 2010’ at the *Center for Turbulence Research, Stanford University*, on “A new class of numerical methods for Large Eddy Simulation of polydisperse evaporating sprays” (collaboration with R.O. Fox - Iowa State University and EM2C - ECP, J. Réveillon, O. Thomine - CORIA, F. Laurent-Nègre, S. de Chaisemartin - IFP Energies nouvelles, C. Chalons - Paris VII CEA and EM2C - ECP and L. Fréret - Paris VI)
- 2009 - 2010 Participation in a Working-group of l’ESA (European Spatial Agency) “Kinetic Theory for Hypersonic Flows”, Coordination D. Giordano, ESTEC/ESA, gathering a group of scientist from Russia, Italy, USA and Belgium in the field of kinetic theory and multi-scale methods for the fluid description of weakly ionized plasma flows out of thermal and chemical equilibrium
- 2009 - 2012 Participation of the applied mathematics team of EM2C Lab to the DFG-CNRS project “Micro-Macro Modelling and Simulation of Liquid-Vapour Flows”, DFG-CNRS research unit 563, PI of the French part of the project : P. Helluy, IRMA Université de Strasbourg

- 2005 - 2016 Long-term Interaction with R.O. Fox, Iowa State University, invited visit of two-months per year at ECP in May-June, participation in PhD work and common projects (Summer Program 2008, 2010, 2012 Stanford University). R.O. Fox spent his sabbatical year at EM2C laboratory in strong connection with the applied mathematics team and obtained a RBUCE-UP, Excellence European Chair for two years in 2012-2014. Since then the School arranged a follow up with his venue resumes to two-month a year and his is a member of the scientific council of the school.
- 2008 “Fellowship” of \$4000 from the Center for Turbulence Research, Stanford University, for a participation in the “Summer Program 2008” with a project “Evaluation of various models for the description of polydisperse evaporating sprays in multi-dimensional free jet configurations: Lagrangian, equilibrium Eulerian and nonequilibrium Eulerian models” (collaboration with R.O. Fox, J. Réveillon, F. Laurent-Nègre, S. de Chaisemartin, D. Kah and L. Fréret, L. Fréret obtained a fellowship of \$3000 and D. Kah \$2500)
- 2002 “Fellowship” du Center for Turbulence Research, Stanford University, \$ 3000 for a participation in the “Summer Program 2002” with a project “Lagrangian/Eulerian analysis of the subgrid dispersion of vaporizing polydisperse sprays in turbulent flows” (collaboration with J. Réveillon)
- 1998 - 2001 PI of the NATO Grant (Collaborative Research Grant 972212) : “Laminar spray diffusion flames : Modelling, Computations and Experiments”, 35kF Travel money
- 1998 - 1999 Participation in the POLONIUM Project with the *Institute of Fundamental and Technological Problems*, Warsaw, Poland, “Travelling waves in nonlinear and heterogeneous media with diffusion and convection” (PI V. Volpert)

## TEACHING

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- 2015 - 2016 Creation and teaching of an advanced graduate course “Advanced numerical methods and high performance computing for the simulation of complex phenomena”, common to third year Engineering School student specializing in ”Option Mathématiques” at CentraleSupélec and second year Master students in the AMS (Analysis, Modeling and Simulation) Master of Université Paris-Saclay, with L. Séries (technical manager of the mésocentre of CentraleSupélec and ENS Cachan) and M. Duarte.
- 2012 - 2015 Participation in the graduate course “Modeling and high performance computing”, third year Engineering School student specializing in ”Option Mathématiques” at CentraleSupélec organized by F. Mangeant, AIRBUS/EADS and in collaboration with L. Séries
- 2011 - 2016 Creation of an Advanced Graduate Course 30 hours, Université de Stanford, Department of Mechanical Engineering, Winter Quarter - Advanced Fluid Mechanics Multiphase Flows en 2011-2012. This course has evolved into an advanced graduate course at CentraleSupélec “Two-phase flows”, common to third year Engineering School student specializing in ”Option Sciences Thermique” at CentraleSupélec and second year Master students in the Energy Master of Université Paris-Saclay - 20h. The course has been opened to third year Engineering School student specializing in ”Option Mechanical and Aerospace Engineering” at CentraleSupélec and second year Master students in the AS-MAE (Aerospace Engineering) Master of Université Paris-Saclay since 2015.
- 2008 Course in the framework of the National Education Action form CNRS : ANGD “Informatique Scientifique pour le Calcul” co-organised by V. Louvet and T. Dumont, two weeks in Sète during Fall 2008 - <http://calcul.math.cnrs.fr/spip.php?rubrique39>
- 2008 - 2011 Teaching of 6 hours in a graduate course in the Master of Science program EFE, Université de Rouen “Modeling of two-phase flows involving polydisperse sprays in evaporation and combustion”
- 2008 - 2014 Undergraduate and graduate course of second year of CentraleSupélec Engineering School (Semester 8) of specialization in applied mathematics “Mathematical aspects of compressible gas flows” within the framework of the course of P. Laurent entitled “Design and Simulation”.

- 2015 - 2016 **RESPONSIBLE FOR THE AEROSPACE ENGINEERING MASTER OF SCIENCE** of Ecole Centrale Paris (Mention Sciences Appliquées) and then of CentraleSupélec (Mention Energie). This master program involves between 25 and 30 students and has become a high level degree in the framework of University Paris-Saclay.
- 2006 - 2008 Elective advanced graduate course with V. Giovangigli (24h) “Mathematical and numerical modeling of multicomponent reacting flows” in the framework of Master Sciences and Technologies, Mention Mathématiques and Applications, Spécialité Mathématiques de la Modélisation, Laboratoire JLL, Université Paris VI and Ecole Polytechnique.
- 2005 - 2016 Advisorship and guidance every year of several 150 hour research projects of Master students both in the AS-MAE (Aerospace Engineering) and Energy Masters of Science of Université Paris-Saclay in the fields of applied mathematics, energetics and fluid mechanics.
- 2003 - 2016 Advanced graduate course “Compressible and Supersonic Flows” (27 hours) common to third year Engineering School student specializing in “Option Mechanical and Aerospace Engineering” at CentraleSupélec and second year Master students in the AS-MAE (Aerospace Engineering) Master of Université Paris-Saclay.
- 2002 - 2004 Graduate course (DEA, that is Master Course at the time) “Approximating evolutionary equations: modeling, numerical analysis and programming”, Master of Science “PDEs, scientific computing and numerical analysis” of the “Mathématiques et Informatique Fondamentale” Doctoral School of Lyon; joint teaching with S. Descombes, UMPA - UMR 5669 - ENS Lyon
- 1999 - 2004 Course at Collège de Polytechnique : “Spray Combustion Modelling” in the framework of continuing education of working engineers, half a day in the Lecture Series “Numerical methods and fluid mechanics” organized by Y. Maday.
- 1998 - 2003 Advanced graduate course in the framework of the preparation of the “Agrégation de Mathématiques”, “Modeling” oral exam (30 hours) at Université Claude Bernard Lyon 1.
- 1999 - 2000 Advanced graduate course in the framework of the preparation of the “Agrégation de Mathématiques”, “Modeling” oral exam (12 hours) at Ecole Normale Supérieure de Lyon .
- 1996 - 1997 Graduate Course : *Applied Numerical Methods*, Department of Mechanical Engineering, *Yale University*, 6 hours a week during the Fall Semester
- 1995 - 1996 Teaching assistant with professor V. Girault in Licence de Mathématiques at l’Université Pierre and Marie Curie, Paris VI, second semester, 40 students.

## LANGUAGES

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English : fluent, and German: advanced level, both oral and written

## OTHER AREAS OF INTEREST

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Philosophy and History of Science, Participation in the Groupe D’Alembert editing the complete scientific works of D’Alembert

Batchelor’s degree in Philosophy at l’Université de Paris I – Panthéon Sorbonne, 1994

Sport : back-country skiing, snowboarding, alpinisme, sailing and federal instructor of windsurfing.

### INTERNATIONAL : PUBLICATIONS

- [A1] T. T. Nguyen, F. Laurent, R.O. Fox, M. Massot, *Solution of population balance equations in applications with fine particles: mathematical modeling and numerical schemes*, to appear in Journal of Computational Physics (2016) 1-42 <https://hal.archives-ouvertes.fr/hal-01247390>
- [A2] B. Fiorina, A. Vi, B. Franzelli, N. Darabiha, M. Massot, G. Dayma, P. Dagaut, V. Moureau, L. Vervisch, A. Berlemont, V. Sabelnikov, E. Riber, B. Cuenot, *Modeling Challenges in Computing Aeronautical Combustion*, to appear in Aerospace Lab. Issue 11, June (2016) 1-19
- [A3] M. Essadki, S. de Chaisemartin, S. Jay, M. Massot, F. Laurent and A. Larat, *Adaptive mesh refinement for polydisperse evaporating spray simulation on massively parallel architecture*, to appear in Oil & Gas Science and Technology (2016) 1-24
- [A4] S. Descombes, M. Massot, M. Duarte, *Operator splitting methods with error estimator and adaptive time-stepping. Application to the simulation of combustion phenomena*, contribution invitée par Roland Glowinski, Stanley Osher and Wotao Yin. To appear in the book “Splitting Methods in Communication and Imaging, Science and Engineering”, Chapter 19, Springer (2016) 1-13 <https://hal.archives-ouvertes.fr/hal-01183745>
- [A5] O. Emre, D. Kah, S. Jay, Q.-H. Tran, A. Velghe, S. de Chaisemartin, R.O. Fox, F. Laurent, M. Massot, *Eulerian Moment Methods for Automotive Sprays*, Atomization & Sprays Vol. 25, No. 3 (2015) 189-254
- [A6] M. Duarte, Z. Bonaventura, M. Massot, and A. Bourdon, *A Numerical strategy to discretize and solve Poisson equation on dynamically adapted multiresolution grids for time-dependent streamer discharge simulation*, Journal of Computational Physics, 289 (2015) 129-148
- [A7] C. Chalons, M. Massot, A. Vié, *On the Eulerian Large Eddy Simulation of disperse phase flows: and asymptotic preserving scheme for small Stokes number flows*, SIAM Multiscale Modeling and Simulation Vol 13, No. 1 (2015) 291-315
- [A8] M. Boileau, C. Chalons, M. Massot. *Robust numerical coupling of pressure and pressureless gas dynamics equations for Eulerian spray DNS and LES*. SIAM J. Sci. Comput., Vol. 37, No. 1 (2015) B79-B102
- [A9] D. Kah, O. Emre, Q.H. Tran, S. de Chaisemartin, S. Jay, F. Laurent, and M. Massot. *High order moment method for polydisperse evaporating spray with mesh movement : application to internal combustion engines*. International Journal of Multiphase Flows, Vol. 71 (2015) 38–65
- [A10] A. Vié, F. Doisneau, M. Massot, *On the Anisotropic Gaussian closure for the prediction of inertial-particle laden flows*, Communication in Computational Physics, Vol 17, No. 1 (2015) 1-46
- [A11] M. Sabat, A. Larat, A. Vié, M. Massot, *On the development of high order realizable schemes for the Eulerian simulation of disperse phase flows: a convex-state preserving Discontinuous Galerkin method*, Journal of Computational Multiphase Flows Vol 6, No. 3 (2014) 247–270
- [A12] O. Emre, R.O. Fox, M. Massot, S. de Chaisemartin, S. Jay, F. Laurent, *Eulerian modeling of a polydisperse evaporating spray under realistic internal-combustion-engine conditions*, Flow, Turbulence and Combustion, Vol. 93, Issue 4 (2014) 689-722
- [A13] T. Sayadi, V. Le Chenadec, P. Schmid, F. Richecoeur, M. Massot. *Thermoacoustic instability a dynamical system and time domain analysis*. Journal of Fluid Mechanics, 753 (2014) 448-471 - <http://arxiv.org/abs/1312.3101>
- [A14] T. Sayadi, V. Le Chenadec, P. Schmid, F. Richecoeur, M. Massot. *Time-domain Analysis of Thermo-Acoustic Instabilities in a Ducted Flame*, 35th International Symposium on Combustion, San Francisco, Proceedings of the Combustion Institute, Vol. 35 (2014) 1079-1086

- [A15] R. Zamansky, F. Coletti, M. Massot, A. Mani, *Radiation induces turbulence in particle-laden fluid*, Physics of Fluids, 26, 7 (2014) 071701
- [A16] S. Descombes, M. Duarte, T. Dumont, F. Laurent, V. Louvet, M. Massot, *Analysis of operator splitting in the non-asymptotic regime for nonlinear reaction diffusion equations. Application to the dynamics of premixed flames*, SIAM Journal of Numerical Analysis, Vol. 52, No. 3 (2014) 1311-1334
- [A17] F. Doisneau, A. Sibra, J. Dupays, A. Murrone, F. Laurent, M. Massot, *An efficient and accurate numerical strategy for two-way coupling in unsteady polydisperse moderately dense sprays: application to Solid Rocket Motor instabilities*, Journal of Propulsion and Power, Vol 30, No. 3 (2014) 727-748
- [A18] M. Duarte, S. Descombes, C. Tenaud, S. Candel, M. Massot, *Time-space adaptive numerical methods for the simulation of combustion fronts*, Combustion and Flame, Vol. 160 (2013) 1083-1101
- [A19] T. Dumont, M. Duarte, S. Descombes, M.-A. Dronne, M. Massot, V. Louvet, *Simulation of human ischemic stroke in realistic 3D geometry : a numerical strategy*, Communications in Nonlinear Science and Numerical Simulation, Vol. 18, Issue 6 (2013) 1539-1557
- [A20] A. Vié, S. Jay, B. Cuenot, M. Massot, *Accounting for Polydispersion in the Eulerian Large Eddy Simulation of the Two-Phase Flow in an Aeronautical-type Burner*, Flow Turbulence and Combustion, Vol. 90, No 3 (2013) 545-581
- [A21] A. Vié, F. Laurent, M. Massot, *Size-velocity correlations in high order moment methods for polydisperse evaporating sprays: modelling and numerical issues*, Journal of Computational Physics, Vol 237 (2013) 277-310
- [A22] F. Doisneau, F. Laurent, A. Murrone, J. Dupays, M. Massot, *Eulerian Multi-Fluid models for the simulation of dynamics and coalescence of particles in solid propellant combustion*, Journal of Computational Physics, Vol. 234 (2013) 230-262
- [A23] F. Doisneau, J. Dupays, A. Murrone, F. Laurent, M. Massot, *Eulerian versus Lagrangian simulation of unsteady two-way coupled coalescing two-phase flows in solid propellant combustion*, Comptes Rendus Mécanique, Volume 341, Issues 1-2 (2013) 44-54
- [A24] A. Vié, F. Laurent, M. Massot, *A high order moment method for the simulation of polydisperse two-phase flows*, Comptes Rendus Mécanique, Volume 341, Issues 1-2 (2013) 55-64
- [A25] J. Caudal, F. Fiorina, M. Massot, B. Labégorre, N. Darabiha, O. Gicquel, *Characteristic time scales identification in reactive flows*, Symposium (International) on Combustion, août 2012, Proceedings of the Combustion Institute, Vol. 34, 1 (2013) 1357-1364
- [A26] M. Duarte, A. Bourdon and M. Massot, Z. Bonaventura, *Derivation of a merging condition for two interacting streamers in air*, Plasma Sources Science and Technology, Vol. 21, No. 5 (2012) 052001 1-5
- [A27] C. Chalons, D. Kah, M. Massot, *Beyond pressureless gas dynamics : Quadrature-based velocity moment models*, Communication in Mathematical Sciences Vol. 10, Issue 4 (2012) 1241-1272
- [A28] Duarte M., Bonaventura Z., Massot M., Bourdon A., Descombes S., Dumont T., *A new numerical strategy with space-time adaptivity and error control for multi-scale streamer discharge simulations*, Journal of Computational Physics, Vol. 231, 3 (2012) 1002-1019
- [A29] Duarte M., Massot M., Descombes S., Tenaud C., Dumont T., Louvet V., Laurent F., *New resolution strategy for multi-scale reaction waves using time operator splitting, space adaptive multiresolution and dedicated high order implicit/explicit time integrators*, SIAM Journal on Scientific Computing 34, 1 (2012) 76-104
- [A30] Kah D., Laurent F., Massot M., Jay S., *A high order moment method simulating evaporation and advection of a polydisperse liquid spray*, Journal of Computational Physics 231, 2 (2012) 394-422

- [A31] Descombes S., Duarte M., Dumont T., Louvet V., Massot M., *Adaptive time splitting method for multi-scale evolutionary partial differential equations*, Article dedicated to the memory of M. Schatzman, *Confluentes Mathematici* 3 (2011) 1-31
- [A32] C. Lacour, D. Durox, S. Ducruix and M. Massot, *Interaction of a polydisperse spray with vortices*, *Experiments in Fluids*, 51, 2 (2011) 295-311
- [A33] M. Duarte, M. Massot, S. Descombes, *Parareal operator splitting techniques for multi-scale reaction waves : numerical analysis and strategies*, *M2AN*, 45, 5 (2011) 825-852
- [A34] Kah D., Laurent F., Massot M., Jay S., *A high order moment method simulating evaporation and advection of a polydisperse liquid spray*, *Journal of Computational Physics* 231, 2 (2012) 394-422
- [A35] Descombes S., Duarte M., Dumont T., Louvet V., Massot M., *Adaptive time splitting method for multi-scale evolutionary partial differential equations*, *Confluentes Mathematici* 3 (2011) 1-31
- [A36] C. Lacour, D. Durox, S. Ducruix and M. Massot, *Interaction of a polydisperse spray with vortices*, *Experiments in Fluids*, 51, 2 (2011) 295-311
- [A37] M. Duarte, M. Massot, S. Descombes, *Parareal operator splitting techniques for multi-scale reaction waves : numerical analysis and strategies*, *M2AN*, 45, 5 (2011) 825-852
- [A38] V. Giovangigli, B. Graille, T. E. Magin, and M. Massot, *Multicomponent Transport in Weakly Ionized Mixtures*, *Plasma Sources Sci. Tech.*, Vol. 19, No 3 (2010) 1–6
- [A39] D. Kah, F. Laurent, L. Fréret, S. de Chaisemartin, R.O. Fox, J. Reveillon, M. Massot, *Eulerian quadrature-based moment models for dilute polydisperse evaporating sprays*, *Flow, Turbulence and Combustion*, Special Issue dedicated to S. B. Pope, Vol. 85, No. 3-4 (2010) 649-676
- [A40] M. Massot, F. Laurent, D. Kah, S. de Chaisemartin, *A robust moment method for the evaluation of the disappearance rate of evaporating sprays*, *SIAM Journal of Applied Maths*, Vol. 70, No. 8 (2010) 3203-3234 disponible sur HAL <http://hal.archives-ouvertes.fr/hal-00332423/fr/>
- [A41] S. de Chaisemartin, L. Fréret, D. Kah, F. Laurent, R.O. Fox, J. Reveillon and M. Massot, *Eulerian models for turbulent spray combustion with polydispersity and droplet crossing*, *Comptes Rendus Mécanique* 337, Special Issue on “Combustion for aerospace propulsion” (2009) 438–448
- [A42] B. Graille, T. Magin, M. Massot, *Kinetic Theory of Plasmas : Translational Energy*, *Math. Models and Methods in Applied Sciences*, 19, 04 (2009) 527-599- 72 pages
- [A43] L. Fréret, C. Lacour, S. de Chaisemartin, S. Ducruix, D. Durox, F. Laurent, M. Massot, *Pulsated free jets with polydisperse spray injection: experiments and numerical simulations*, *Symposium (International) on Combustion*, août 2008, McGill University, Canada (2009) 8 pages
- [A44] F. Laurent, M. Massot, R. O. Fox, *Numerical simulation of polydisperse, dense liquid sprays in an Eulerian framework: direct quadrature method of moments and multi-fluid method*, *Journal of Computational Physics*, Vol. 227, No. 6 (2008) 3058-3088
- [A45] S. Descombes, T. Dumont, V. Louvet, M. Massot, *On the local and global errors of splitting approximations of reaction-diffusion equations with high spatial gradients*, *International Journal of Computer Mathematics*, Special Issue on Splitting Methods for Differential Equations, Ed. Q. Sheng Vol. 84, No. 6(2006) 749–765
- [A46] N. Lygeros, P-V. Marchand, M. Massot, *Enumeration and 3-D representation of the stereo-isomers of alkane molecules*, *J. of Symbolic Computation* 40(2005)1225–1241
- [A47] F. Laurent, V. Santoro, M. Noskov, A. Gomez, M.D. Smooke, M. Massot, *Accurate treatment of size distribution effects in polydisperse spray diffusion flames : multi-fluid modeling, computations and experiments*, *Combustion Theory and Modelling*, Vol. 8, No. 2(2004)385–412
- [A48] J. Réveillon, C. Péra, M. Massot, R. Knikker, *Eulerian analysis of the dispersion of evaporating polydispersed sprays in a statistically stationary turbulent flow*, *J. of Turbulence*, Vol. 5, No. 1 (2004)1–27

- [A49] F. Laurent, M. Massot, P. Villedieu, *Eulerian multi-fluid modeling for the numerical simulation of polydisperse dense liquid sprays*, Journal of Computational Physics, Vol. 194, No. 2 (2004) 505–543
- [A50] S. Descombes, M. Massot, *Operator splitting for nonlinear reaction-diffusion systems with an entropic structure : singular perturbation and order reduction*, Numerische Mathematik, Vol. 97, No. 4 (2004) 667–698
- [A51] V. Giovangigli, M. Massot, *Multicomponent reactive flows : reduced chemistry and entropic structure on partial equilibrium manifolds*, Mathematical Methods in the Applied Sciences, Vol. 27, No. 7(2004)739–768
- [A52] V. Volpert, B. Kazmierczak, M. Massot, Z. Peradzynski, *Solvability conditions for elliptic problems with non Fredholm operators*, Applicationes Mathematicae, Vol. 29, No. 2 (2002) 219–238
- [A53] M. Massot, *Singular perturbation analysis for the reduction of complex chemistry in gaseous mixtures using the entropic structure*, Discrete and Continuous Dynamical Systems - Series B, Vol. 2, No. 3 (2002) 433–456
- [A54] T. Dumont, S. Genieys, M. Massot, V. Volpert, *Nonlinear coupling of thermal explosion and natural convection : critical conditions and new oscillating regimes*, SIAM Journal of Applied Mathematics, Vol. 83, No. 1 (2002) 351–372
- [A55] F. Laurent, M. Massot, *Multi-Fluid Modeling of Laminar Poly-dispersed Spray Flames : Origin, Assumptions and Comparison of Sectional and Sampling Methods*, Combustion Theory and Modelling, Vol. 5, No. 4 (2001) 537–572
- [A56] M. Massot, M. Kumar, A. Gomez, M.D. Smooke, *Counterflow spray diffusion flames of heptane: computations and experiments*, 27th Symposium (Int.) on Combustion (1998) 1975–1984
- [A56] V. Giovangigli and M. Massot, *Asymptotic Stability of Equilibrium States for Multicomponent Reacting Flows*, Math. Models and Methods in Applied Sciences, Vol. 8, No. 2, (1998) 251–297
- [A58] V. Giovangigli, M. Massot, *The Local Cauchy Problem for Multicomponent Reactive Flows in Full Vibrational Nonequilibrium*, Math. Meth. Appl. Sci., Vol. 21, No. 15 (1998) 1415–1439

#### NATIONAL PUBLICATIONS

- [A59]<sup>†</sup> G. Dufour, M. Massot, P. Villedieu, *Etude d'un modèle de fragmentation secondaire pour les brouillards de gouttelettes*, C.R. Acad. Sci. Paris, Série I, Math., t. 336, No. 5 (2003) 447–452
- [A60]<sup>†</sup> F. Laurent, M. Massot, V. Volpert, *Propagation de flammes gazeuses dans la limite d'une diffusion massique nulle*, C.R. Acad. Sci. Paris, Série I, Math., t. 335 (2002) 405–410
- [A61] M. Massot, *Singular perturbation analysis for the reduction of complex chemistry in gaseous mixtures using the entropic structure*, C.R. Acad. Sci. Paris, Série I, Math., t. 335 (2002) 93–98
- [A62] M. Massot, P. Villedieu, *Eulerian multi-fluid modeling for the numerical simulation of polydisperse dense liquid sprays*, C. R. Acad. Sci. Paris, Série I, Math., t. 332, No. 9(2001) 869–874
- [A63] V. Giovangigli and M. Massot, *Les Mélanges Gazeux Réactifs : (I) Symétrisation and Existence Locale*, Note au C.R. Acad. Sci. Paris, Série I, Math., t. 323 (1996) 1153–1158
- [A64] V. Giovangigli and M. Massot, *Les Mélanges Gazeux Réactifs : (II) Stabilité Asymptotique des Etats d'Equilibre*, Note au C.R. Acad. Sci. Paris, Série I, Math., t. 323 (1996) 1207–1212

#### INTERNATIONAL : BOOK CHAPTERS

- [A65] R. Zamansky, F. Colletti, M. Massot and A. Mani, *Buoyancy-driven turbulent flow in particle-laden fluid subject to radiation*, Annual Research Brief of the Center for Turbulence Research (2012) 217-228 <http://ctr.stanford.edu/publications.html>

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<sup>†</sup>This note to the Comptes Rendus of the Academia of Science is an article per se and is not the subject of a separate publication.



- [A66] A. Larat, M. Massot and A. Vié, *A stable, robust and high order accurate numerical method for Eulerian simulation of spray and particle transport on unstructured meshes*, Annual Research Brief of the Center for Turbulence Research (2012) 205-216 <http://ctr.stanford.edu/publications.html>
- [A67] F. Laurent, A. Vié, C. Chalons, R.O. Fox, M. Massot, *Two-Layer Mesoscopic Modeling of Bag Break-up in Turbulent Secondary Atomization*, Annual Research Brief of the Center for Turbulence Research (2012) 193-204 <http://ctr.stanford.edu/publications.html>
- [A68] N. Rimbart, F. Doisneau, F. Laurent, D. Kah and M. Massot, *A hierarchy of Eulerian models for trajectory crossing in particle-laden turbulent flows over a wide range of Stokes numbers*, Volume du Summer Program 2012è, publication du Center for Turbulence Research, Stanford University (2012) 335-344 <http://ctr.stanford.edu/publications.html>
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- [A73] Kah D., Vié A., Chalons C., Massot M., *Second-order scheme for quadrature-based velocity high order moment methods for disperse two-phase flows*, Dans Annual Research Briefs of the Center for Turbulence Research (2012) 321-334
- [A74] Duarte M., Massot M., Descombes S., Tenaud C., Candel S., *Time-space adaptive numerical methods for the simulation of combustion fronts*, Dans Annual Research Briefs of the Center for Turbulence Research (2012) 347-358
- [A75] Duarte M., Massot M., Descombes S., Tenaud C., Dumont T., Louvet V., Laurent F., *New Resolution Strategy for Multi-scale Reaction Waves using Time Operator Splitting and Space Adaptive Multiresolution: Application to Human Ischemic Stroke*, Dans Summer school on multiresolution and adaptive mesh refinement methods, ESAIM Proceedings, V. Louvet, E. Cancès and M. Massot Eds. (2011) 277-290
- [A76] L. Fréret, O. Thomine, J. Reveillon, S. de Chaisemartin, F. Laurent and M. Massot, *On the role of preferential segregation in flame dynamics in polydisperse evaporating sprays*, Volume du Summer Program 2010è, publication du Center for Turbulence Research de Stanford University (2011) 10 pages, <http://www.stanford.edu/group/ctr/publications.html>
- [A77] C. Chalons, R. O. Fox and M. Massot, *A multi-Gaussian quadrature method of moments for gas-particle flows in a LES framework*, Volume des Proceedings du Summer Program 2010è, publication du Center for Turbulence Research de Stanford University (2011) 12 pages, <http://www.stanford.edu/group/ctr/publications.html>
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- [A83] S. de Chaisemartin, L. Fréret, D. Kah, F. Laurent, R.O. Fox, J. Reveillon and M. Massot, *Turbulent combustion of polydisperse evaporating sprays with droplet crossing: Eulerian modeling of collision at finite Knudsen and validation*, Volume du “Summer Program 2008”, publication du Center for Turbulence Research de Stanford University (2009) 12 pages
- [A84] B. Graille, T. Magin, M. Massot, *Modeling of reactive plasmas for atmospheric entry flows based on kinetic theory*, Volume du “Summer Program 2008”, publication du Center for Turbulence Research de Stanford University (2009) 12 pages
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- [R3] M. Essadki, S. de Chaisemartin, F. Laurent, M. Massot, *High order moment model for polydisperse evaporating sprays towards interfacial geometry description*, submitted to SIAM Applied Mathematics (2016) 1-42 <https://hal.archives-ouvertes.fr/hal-01355608>
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- [R6] S. Descombes, M. Duarte, T. Dumont, T. Guillet, V. Louvet, M. Massot, Task-based adaptive multiresolution for time-space multi-scale reaction-diffusion systems on multi-core architectures, submitted to SMAI - JCM (2015) 1-24 <https://hal.archives-ouvertes.fr/hal-01148617>
- [R7] C. Audouze, M. Massot and S. Volz, *Multi-step symplectic parareal algorithm for molecular dynamics*, (2009) <http://hal.archives-ouvertes.fr/hal-00358459/fr/>
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- [B2] M. Massot, A. Larat, F. Laurent-Nègre, *Modélisation mathématique and simulation numérique des écoulements compressibles and supersoniques*, issu du polycopier de 3ème année de Centrale-Supélec, soumission prévue en 2016
- [B3] V. Louvet, M. Massot and E. Cances, Editors, *Adaptive Multi-resolution methods and Adaptive Mesh Refinement : from theoretical numerical analysis fundamentals to implementation issues*, Proceedings of the Summer School, Fréjus, 14-18 June 2010, ESAIM Proceedings (2011)

#### INTERNATIONAL PROCEEDINGS:

- [C0] F. Drui, A. Fikl, P. Kestener, S. Kokh, A. Larat, V. Le Chenadec, M. Massot, *Experimenting with the p4est library for AMR simulations of two-phase flows*, à paraître dans ESAIM: Proceedings and surveys, CEMRACS, M. Campos Pinto and F. Charles, Editors, March, Vol. 53 (2016) 232-247
- [C1] F. Drui, A. Larat, S. Kokh, M. Massot, *A hierarchy of compressible two-fluid models with identified physical relaxations and related numerical methods for the simulation of separated and dispersed phases*, Dans Proceedings of the 9th International Conference on Multiphase Flow (ICMF) Firenze, Italy, May 22 - 27 (2016) 6p.
- [C2] M. Sabat, A. Vié, A. Larat, M. Massot, *Fully Eulerian simulation of 3D turbulent particle laden flow based on the Anisotropic Gaussian Closure*, Dans Proceedings of the 9th International Conference on Multiphase Flow (ICMF) Firenze, Italy, May 22 - 27 (2016) 6p.
- [C3] M. Essadki, S. de Chaisemartin, M. Massot, F. Laurent, A. Larat, S. Jay, *A new high order moment method for polydisperse evaporating sprays dedicated to the coupling with separated two-phase flows in automotive engine*, Dans Proceedings of the 9th International Conference on Multiphase Flow (ICMF) Firenze, Italy, May 22 - 27 (2016) 6p.
- [C4] V. Dupif, M. Massot, J. Dupays, F. Laurent, *On the influence of the numerical strategy on the predictive character of Euler-Euler model for two-phase flow simulations in solid rocket motor*

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- [C5] J.-C. Brändle De Motta, B. Robbes, F. Shum Kivan, M. Boileau, M. Massot, E. Riber, B. Cuenot, L. Zimmer, *Experimental and numerical investigation of a pulsated evaporating spray*, Dans Proceedings of the 9th International Conference on Multiphase Flow (ICMF) Firenze, Italy, May 22 - 27 (2016) 6p.
- [C6] M. Boileau, J. Lagarde, V. Dupif, F. Laurent and M. Massot, *Two-size moment Eulerian multi-fluid method describing the statistical trajectory crossing: modeling and numerical scheme*, Dans Proceedings of the 9th International Conference on Multiphase Flow (ICMF) Firenze, Italy, May 22 - 27 (2016) 6p.
- [C7] R. Zamansky, F. Coletti, M. Massot, A. Mani, *Turbulent thermal convection induced by the heating of a particle suspension*, Dans Proceedings of the 9th International Conference on Multiphase Flow (ICMF) Firenze, Italy, May 22 - 27 (2016) 6p.
- [C8] F. Drui, A. Larat, V. Le Chenadec, S. Kokh, M. Massot, *A hierarchy of two-fluid models with specific numerical methods for the simulation of bubbly flows/acoustic interactions*, Bulletin of the American Physical Society 67th Annual Meeting of the Div. of Fluid Dynamics, Vol 59 No 20
- [C9] M. Sabat, A. Larat, A. Vié, M. Massot, *On the development of high order realizable schemes for the Eulerian simulation of disperse phase flows on unstructured grids: a convex-state preserving Discontinuous Galerkin method*, Dans Proceedings of the 8th International Conference on Multiphase Flow (ICMF) Jeju, Korea, May 26 - 31 (2013) 12p.
- [C10] O. Emre, M. Massot, S. de Chaisemartin, S. Jay, F. Laurent, *Eulerian modeling of polydisperse evaporating spray under realistic internal combustion engine conditions*, Dans Proceedings of the 8th International Conference on Multiphase Flow (ICMF) Jeju, Korea, May 26 - 31 (2013) 12p.
- [C11] F. Doisneau, J. Dupays, F. Laurent, M. Massot, *Efficient numerical coupling strategy for evaporating polydisperse sprays in unsteady multi-species flows: Application to solid rocket motor simulations*, Dans Proceedings of the 5th EUROPEAN CONFERENCE FOR AEROSPACE SCIENCES, Munich, Germany, July (2013)
- [C12] A. Sibra, J. Dupays, F. Laurent, M. Massot, *A new Eulerian Multi-Fluid model for bi-component polydisperse sprays: an essential approach to evaluate the impact of aluminum combustion on Solid Rocket Motor instabilities*, Dans Proceedings of the 47th AIAA/ASME/SAE/ASEE Joint Propulsion Conference & Exhibit, and 11th International Energy Conversion Engineering Conference, Etats-Unis, July (2013)
- [C13] M. Massot, B. Graille and T. Magin, *Hydrodynamic Model for Molecular Gases in Thermal Nonequilibrium*, 28th International Symposium on Rarefied Gas Dynamics, Zaragoza, Spain, July 2012 - Vol. 1501 (2012)231–238
- [C14] A. Sibra, F. Laurent, J. Dupays, M. Massot, A. Murrone, *Numerical coupling strategy for two-phase flow computations: application to solid rocket motors*, ECCOMAS 2012 conference, Mini-symposium MS209-2 Vienna 2012 “Numerical modeling of separated and dispersed two-phase flows” organized by A. Murrone, B. Koren (2012)
- [C15] A. Vié, C. Chalons, F. Laurent, R.O. Fox, M. Massot, *Towards realizable large-eddy simulation of two-phase flows: multi-Gaussian quadrature and dedicated numerical methods*, ECCOMAS 2012 conference, Mini-symposium MS209-2 Vienna 2012 “Numerical modeling of separated and dispersed two-phase flows” organized by A. Murrone, B. Koren (2012)
- [C16] O. Emre, F. Laurent, S. de Chaisemartin, S. Jay, M. Massot, *Two-way coupling modeling through Eulerian moment method for spray injection in engine simulations*, ECCOMAS 2012 conference, Mini-symposium MS209-2 Vienna 2012 “Numerical modeling of separated and dispersed two-phase flows” organized by A. Murrone, B. Koren (2012)

- [C17] F. Doisneau, J. Dupays, F. Laurent, M. Massot, *Hybrid multi-fluid methods for coalescing nano-to-inertial sprays*, ECCOMAS 2012 conference, Mini-symposium MS209-2 Vienna 2012 “Numerical modeling of separated and dispersed two-phase flows” organized by A. Murrone, B. Koren (2012)
- [C18] F. Doisneau, J. Dupays, F. Laurent, M. Massot, *Two-way coupled simulation of acoustic waves in polydisperse coalescing two-phase flows : application to Solid Rocket Motor instabilities*, Dans Proceedings of the 4th EUROPEAN CONFERENCE FOR AEROSPACE SCIENCES, Russie, Fédération De (2011)
- [C19] T. Magin, B. Graille, M. Massot, *Kinetic theory derivation of transport equations for gases with internal energy*, dans Proceedings of the 42nd AIAA Thermophysics Conference, états-Unis (2011)
- [C20] M. Duarte, M. Massot, S. Descombes, T. Dumont, *Adaptive Time-Space Algorithms for the Simulation of Multi-scale Reaction Waves*, dans Finite Volumes for Complex Applications VI - Problems & Perspectives - Finite Volumes for Complex Applications VI, Tchèque, République (2011)
- [C21] F. Doisneau, A. Sibra, J. Dupays, A. Murrone, M. Massot, F. Laurent, *Numerical strategy for two-way coupling in unsteady polydisperse moderately dense sprays*, dans Proceedings of the 47th AIAA/ASME/SAE/ASEE Joint Propulsion Conference & Exhibit, Etats-Unis (2011)
- [C22] M. Massot, B. Graille and T. Magin, *Thermo-chemical dynamics and chemical quasi-equilibrium of plasmas in thermal non-equilibrium*, 27th International Symposium on Rarefied Gas Dynamics, Pacific Grove, California, USA, july 2010 - paper 305 (2010) 1–6
- [C23] A. Vié, M. Sanjosé, S. Jay, C. Angelberger, B. Cuenot and M. Massot, *Evaluation of a Multifluid Mesoscopic Eulerian Formalism on the Large Eddy Simulation of an aeronautical-type configuration*, Proceedings of the 7th International Conference on Multiphase Flow, ICMF 2010, Tampa, FL, May 30 - June 4 (2010) 15p.
- [C24] F. Doisneau, J. Dupays, F. Laurent and M. Massot, *Optimal Eulerian model for the simulation of dynamics and coalescence of alumina particles in solid propellant combustion*, Proceedings of the 7th International Conference on Multiphase Flow, Tampa, FL, May 30 - June 4 (2010) 15p.
- [C25] D. Kah, Q.H. Tran, S. Jay, F. Laurent, M. Massot, *A high order moment method with mesh movement for the description of a compressible polydisperse evaporating spray*, Proceedings of the 7th International Conference on Multiphase Flow, Tampa, FL, May 30 - June 4 (2010) 15p.
- [C26] L. Freret, S. de Chaisemartin, J. Reveillon, F. Laurent and M. Massot, *Eulerian models and three-dimensional numerical simulation of polydisperse evaporating sprays*, Proceedings of the 7th International Conference on Multiphase Flow, Tampa, FL, May 30 - June 4 (2010) 15p.
- [C27] M. Boileau, C. Chalons, F. Laurent, L. Fréret, S. de Chaisemartin and M. Massot, *Robust numerical schemes for Eulerian spray DNS and LES in two-phase turbulent flows*, Proceedings of the 7th International Conference on Multiphase Flow, Tampa, FL, May 30 - June 4 (2010) 15p.
- [C28] T. Magin, B. Graille and M. Massot, *Kinetic Theory of Plasmas : Translational Energy*, AIAA Aerospace Sciences Meeting and Exhibit, Reno, USA, january 2008 (2008)
- [C29] F. Laurent, M. Massot, R.O. Fox, *Numerical simulation of polydisperse, dense liquid sprays in an Eulerian framework: direct quadrature method of moments and multi-fluid method*, Proceedings of the “International Conference on Multiphase Flows”, Leipzig, Allemagne (2007) 15p.
- [C30] S. de Chaisemartin, L. Fréret, F. Laurent, M. Massot, C. Lacour, A.L. Birbaud, S. Ducruix, D. Durox, *Pulsated free jets with spray injection : Eulerian multi-fluid modelling and simulation versus experimental measurements*, Proceedings of the “International Conference on Multiphase Flows”, Leipzig, Allemagne (2007) 15p. <http://hal.archives-ouvertes.fr/hal-00191015/fr/>
- [C31] S. de Chaisemartin, F. Laurent, M. Massot, *Eulerian multi-fluid method for the numerical simulation of evaporating polydisperse sprays : modelling and numerical issues in multi-dimensional configurations*, Actes de l’“International Conference on Multiphase Flows”, Leipzig, Allemagne (2007) 15p.

- [C32] S. de Chaisemartin, F. Laurent, M. Massot, J. Reveillon, *Evaluation of Eulerian Multi-Fluid versus Lagrangian methods for the ejection of polydisperse evaporating sprays by vortices*, Proceedings of the “International Conference on Multiphase Flows”, Leipzig, Allemagne (2007) 15p.
- [C33] M. Massot, R. Knikker, C. Péra, J. Réveillon, *Lagrangian/Eulerian analysis of the dispersion of evaporating sprays in non-homogeneous turbulent flows*, Actes de l’“International Conference on Multiphase Flows”, Japan (2004)
- [C34] F. Laurent, M. Massot, *Eulerian multi-fluid modeling of polydisperse evaporating sprays*, Actes de l’“International Conference on Multiphase Flows”, Japan (2004)
- [C35] C. Péra, M. Massot, J. Réveillon, *Lagrangian/Eulerian analysis of the dispersion of vaporizing polydispersed sprays in turbulent flows*, Actes du Colloque “Turbulent and Shear Flow Phenomena”, Japan (2003)
- [C36] S. Descombes, T. Dumont, M. Massot, *Operator splitting for nonlinear reaction-diffusion systems with an entropic structure : singular perturbation, order reduction and application to spiral waves*, Actes de la conférence “Patterns and waves : theory and applications”, Saint-Petersbourg, AkademPrint (2003) pages 386–402
- [C37] V. Volpert, T. Dumont, S. Genieys, M. Massot, *Influence of Natural Convection on Heat Explosion (3rd prize for the best paper)*, Actes du 3rd International Seminar on Fire and Explosion Hazards, 10th-14th April, 2000, University of Lancashire, Preston, UK, third prize for the best paper

## PRINCIPAL INVITATIONS

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### INTERNATIONAL CONFERENCES AND INVITED SEMINARS

- [I1] M. Massot, *Eulerian moment methods for evaporating polydisperse sprays: from mathematical issues to HPC*, MUSAF (Multiphysics and Unsteady Simulation for Aeronautical Flows), Toulouse Septembre 2016
- [I2] M. Massot, *Eulerian moment methods for evaporating polydisperse sprays: from mathematical issues to industrial simulations and HPC*, Invited Lecture at SANDIA National Laboratories, Combustion Research Facility, Avril 2016
- [I3] M. Massot, plenary conference at the HPC Days, Lyon, *Mathematical modeling and numerical methods for HPC of multi-scale two-phase flow and combustion engineering applications*, April 2016
- [I4] M. Massot, Plenary Lecture at the Conference SimRace, “première conférence du cycle Rencontres Scientifiques de l’IFPEn”, dedicated to numerical methods and high performance computing for the simulation of flows in industrial configurations, december 2015
- [I5] M. Massot, *Eulerian moment methods for evaporating polydisperse sprays: from mathematical issues to HPC*, Invited Lecture at the von Karman Institute for the Lecture Series: *Industrial Computational Fluid Dynamics*, Rhodes saint Genèse - Bruxelles, September 2015
- [I6] M. Massot, *Eulerian moment methods for evaporating polydisperse sprays: from mathematical issues to HPC*, Invited Seminar by T. Yokomori, Dpt Mechanical Engineering, Keio University, Tokyo, July 2015
- [I7] M. Massot, *Eulerian moment methods for evaporating polydisperse sprays: from mathematical issues to HPC*, Invited Seminar by R. Kurose, Dpt Mechanical Engineering and Science, Kyoto University, July 2015
- [I8] M. Massot, *Hydrodynamics models derived from kinetic theory for weakly ionized plasma flow out of thermal and chemical equilibrium with consistent thermodynamics*, Invited Seminar by K. Aoki and S. Takata, Department of Aeronautics and Astronautics, Kyoto University, July 2015

- [I9] M. Massot, *Eulerian moment methods for automotive spray simulations*, Invited Keynote Lecture at the *47th Fluid Dynamics Conference / 33rd Aerospace Numerical Simulation Symposium*, JAXA, Tokyo, June 2015
- [I10] M. Massot, *Eulerian moment methods for evaporating polydisperse sprays: from mathematical issues to HPC*, Invited Seminar **A LA JAXA** (Agence Spatiale Japonaise), Tokyo, June 2015
- [I11] M. Massot, *Adaptive time-space algorithms for the simulation of multi-scale reaction waves*, Invited Seminar, SpaceX Seminar Series, Hawthorne, California, November 2014
- [I12] M. Massot, *Moment methods and realizable numerical methods for polydisperse sprays and particle-laden flows*, Invited Lecture at the second *Workshop on Moment Methods in Kinetic Theory II*, **AU FIELDS INSTITUTE**, Toronto, October 2014
- [I13] M. Massot, Invitation au *Applied Modeling & Simulation Seminar Series*, NASA Advanced Supercomputing Division, NASA Ames Research Center, *Adaptive Time-Space Algorithms for the Simulations of Multi-Scale Reaction Waves*, August 2014
- [I14] M. Massot, Invitation au *Thermo/Fluids Research Seminar Series*, Mechanical and Aerospace Engineering, Henry Samueli School of Engineering and Applied Science, UCLA, *Adaptive Time-Space Algorithms for the Simulations of Multi-Scale Reaction Waves*, July 2014
- [I15] M. Massot, *Multiphase reacting flows : from modelling issues to high performance computing*, Invited Keynote Lecture at the International Conference on Numerical Methods for Multiphase Flows - Penn State University June 12th-14th (2012)
- [I16] M. Massot, *Eulerian models for the description of polydisperse sprays in two-phase flows: challenging fundamental issues toward industrial applications*, Yale University, Engineering and Applied Sciences Seminar, April (2012)
- [I17] M. Massot, *Eulerian models for the description of polydisperse sprays in two-phase flows: challenging fundamental issues toward industrial applications*, Iowa State University, Engineering Department Seminar, April (2012)
- [I18] M. Massot, *Adaptive time-space algorithms for the simulation of multi-scale reaction waves*, Iowa State University, Mathematics Department Seminar, April (2012)
- [I19] M. Massot, *Eulerian models for the description of polydisperse sprays in two-phase flows: challenging fundamental issues toward industrial applications*, Fluid Mechanics Seminar, Stanford University, February (2012)
- [I20] M. Massot, *Adaptive time-space algorithms for the simulation of multi-scale reaction waves*, Tea Seminar, Center for Turbulence Research, Stanford University, November (2011)
- [I21] M. Massot, *Eulerian moment methods for evaporating polydisperse sprays: from mathematical issues to HPC*, Tea Seminar, Center for Turbulence Research, Stanford University, September (2011)
- [I22] M. Massot, *Multiphase reacting flows : from modelling issues to high performance computing*, Plenary Lecture at the Latin-American Computer Science Conference held at Paraguay, Asuncion, CLEI - October 18-22 (2010)
- [I23] M. Massot, *Eulerian Multi-fluid models : modeling and numerical methods*, von Karman Institute Lecture Series, RTO-NATO-AVT 169 (Research Technology Organization) Lecture Series on "Modelling and Computation of Nanoparticles in Fluid Flows" (2009)
- [I24] S. Descombes, T. Dumont, V. Louvet, M. Massot, *On the local error of splitting approximations of reaction-diffusion equations with high spatial gradients*, ICIAM 2007 Zürich, Mini-symposium Extended splitting methods for partial differential equations: theory and application. Organiser: Juergen Geiser (Humboldt-Universität, Berlin, Germany) (2007)
- [I25] M. Massot, *Eulerian multi-fluid models for the numerical simulation of polydisperse evaporating sprays*, Invited Lecture Series of 6 hours, CISM Lecture Series (Centre International pour les

- Sciences Mécaniques, Udine, Italie) “Computational models for the simulation of multiphase reactive flows” organised by D.L. Marchisio and R.O. Fox, juillet (2006)
- [I26] M. Massot, *Operator splitting techniques for the numerical simulation of reaction waves with multiple scales*, Invited Lecture Series (4h) at Ecole Normale Supérieure de Lyon, GdR CHANT, organised by F. Castella, Professor at Université de Rennes, novembre (2006)
- [I27] M. Massot, *Entropic structure of multicomponent reactive flows with partial equilibrium reduced chemistry*, Colloque “Kinetic and Hyperbolic Equations for Reactive Gases”, Ecole Normale Supérieure de Cachan, March (2004)
- [I28] M. Massot, *Entropic structure and singular perturbation analysis of reactive gaseous mixtures in the limit of partial equilibrium reduced chemistry*, MACKIE 2002, Mathematics in Chemical Kinetics and Engineering, University of Ghent, Belgium, Mai (2002)
- [I29] M. Massot, *Singular perturbation analysis for the reduction of complex chemistry in gaseous mixtures using the entropic structure*, Session “Dynamiques des ondes non-linéaires”, Organisateurs’: J.M. Roquejoffre, C.K.R.T Jones, Franco-American SMF-AMS Conference, Lyon, (2001)

#### INVITED NATIONAL COMMUNICATIONS

- [I30] M. Boileau, M. Massot, *Méthodes multi-échelles and calcul haute performance*, Invited Lecture at the mini-symposium “Impacts and enjeux du calcul intensif en France”, Congrès SMAI, Juin 2015
- [I31] M. Massot, *Méthodes numériques avancées: Modèles à phases dispersées*, Invited Lecture at the “Ecole de Mécanique des Fluides Numérique”, Porquerolles, Juin 2015
- [I32] M. Massot, *Modélisation Eulérienne des écoulements de brouillards de gouttes polydispersés: hiérarchies de modèles and méthodes numériques robustes and précises pour le HPC et les applications industrielles*, Invited Lecture at the ETSN School, CEA-DAM, Porquerolles, Avril 2014
- [I33] M. Massot, *Eulerian modeling and simulation of turbulent disperse gas-particle flows in various asymptotic limits*, Invited Lecture to the annual workshop ”Mécanique des Fluides Numérique”, CEA/GAMNI, Institut Henri Poincaré, 3-4 Février 2014
- [I34] M. Massot, *Méthodes numériques adaptatives pour la simulation de la dynamique de fronts de réaction multiéchelles en temps and en espace*, Keynote Lecture of the Congrès Français de Mécanique, Rencontre Mathématiques and Mécanique, Bordeaux, Août 2013
- [I35] M. Massot, *Eulerian models for the description of polydisperse sprays : from fundamental issues to industrial applications and HPC*, Séminaire de Branche, Branche MFE, ONERA, Juin 2013
- [I36] M. Massot, *Méthodes numériques adaptatives pour la simulation de la dynamique de fronts de réaction multi-échelles temps/espace*, keynote lecture at the Colloque EDP-Normandie, Université du Havre, 23-24 Octobre 2012
- [I37] M. Massot, *Operator splitting techniques for the numerical simulation of reaction waves with multiple scales*, Lecture in the “Groupe de Travail Numérique” organized by Laboratoire de Mathématiques d’Orsay, two sessions in Mai-Juin 2008
- [I38] M. Massot, *Modèles multi-fluides Eulériens pour la simulation des brouillards polydispersés en évaporation*, Cours invité de 1h30 dans le cadre de l’Ecole de Combustion (Ecole nationale CNRS dans le domaine de la combustion, public environ 110 personnes), Anglet 2006
- [I39] A. Guilbaud, M. Massot *Transitions entre une mécanique des fluides expérimentale et une mécanique des fluides mathématisée au XVIIIe siècle*, Seminar of History of Mathematics of the Institut Henri Poincaré, Paris, December 8th 2006 organised by D. Aubin (2006)
- [I40] S. Descombes, M. Massot, *Operator Splitting for Nonlinear Reaction-Diffusion Systems with an Entropic Structure : Singular Perturbation and Order Reduction*, CNRS Lecture Series at GDR EAPQ (E. Lombardi), CIRM, Marseille, April 2002