Emmanuel Franck
Junior researcher INRIA

Personal informations

Nom : Emmanuel Franck
Âge : 33 years, born the 21/05/1986, Paris
Marital situation: single
Nationality : French

Contact :	Professional
	IRMA Strasbourg
	7 Rue René Descartes
	Strasbourg, France
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Work experiences

Since october 2014	**Junior researcher Inria**, IRMA Strasbourg and Inria Nancy Grand Est.
October 2012 - 2014	**Post-doctoral researcher**, Max-Planck Institute of Plasma Physics (Garching, Germany)
Subject	*Numerical and theoretical stability for reduced resistive MHD in the Jorek code*
October 2009 - 2012	**Doctorant**, CEA/DAM (France)
Subject	*Asymptotic preserving schemes on unstructured meshes for linear transport and Friedrichs systems*

Formation

2009-2012	**PhD** in applied mathematics, CEA-DAM, UPMC.
Supervisors	Bruno Després, Christophe Buet
Subject	*Design and numerical analysis of asymptotic preserving schemes on unstructured meshes. Applications to the linear transport and Friedrichs systems.*
Phd Defense	17 october 2012
Jury	Christophe Berthon, Professor, University of Nantes François Bouchut, Senior resaercher, CNRS Christophe Buet, Resaercher-engineer, CEA Bruno Després, Professor, University Paris VI Edwige Godlewski, Professor, University Paris VI Mohammed Lemou, Senior researcher, CNRS Nicolas Seguin, assistant professort, University Paris VI
2009	**Master thesis**, CEA-DAM, UPMC.
Supervisors	Bruno Després, Gilles Kluth

Subjet	*Hyperelastic models for the numerical study of initial conditions in IFC.*

2007-2009	**Master numerical analysis and PDE**, university Paris VI
2006-2007	**Bachelor** in mathematic, informatic and applications, university Paris V

Informatic skills

Systems	Unix/Linux, Mac Os, Windows
Informatic languages	Fortran 2008, C/C++, Python, Julia
Parallel computing	Basic notions of MPI and OpenMP
Mathematic softwares	Scilab, Matlab, GNUplot, R, Visit
Other languages	Latex, HTML

Linguistic skills

Anglais	written, read and spoken
Spanish	Basic Notions

Publications

Refeered papers

[1] C. Buet, B. Després, E. Franck, *Design of asymptotic preserving schemes for the hyperbolic heat equation on unstructured meshes*, Numerish Mathematik, Octobre 2012, Volume 122, Issue 2, pp 227-278.

[2] C. Buet, B. Després, E. Franck, *An asymptotic preserving scheme with the maximum principle for the M_1 model on distorted meshes* , C.R. Acad. Sci., Paris, Sér. I, Math., Vol 350, N 11-12, P. 633-638, Juin 2012

[3] C. Buet, B. Després, E. Franck, *Asymptotic preserving schemes for Friedrichs systems with stiff relaxation on unstructured meshes: applications to the angular discretization models in linear transport*, Journal Scientific Computing, Volume 62 Issue 2, February 2015, Pages 371-398

[4] E. Franck, M. Hölzl, A. Lessig, E. Sonnendrücker, *Energy conservation and numerical stability for the reduced MHD models of the non-linear JOREK code*, ESAIM: Mathematical Modelling and Numerical Analysis 49, 1331 (2015).

[5] C. Buet, B. DesprÈs, E. Franck, T. Leroy, *Proof of uniform convergence for a cell-centered AP discretization of the hyperbolic heat equation on general meshes*, Math. Comp. 86 (2017), 1147-1202.

[6] E. Franck, L. Mendoza, *Finite volume scheme with local high order discretization of hydrostatic equilibrium for Euler equations with external forces*,Journal of Scientific Computing, October 2016, Volume 69, Issue 1, pp 314-354.

[7] E. Franck, L. Gosse, *Stability of a Kirchhoff-Roe scheme for multi-dimensional linearized Euler systems*, Annali Dell' Universita' Di Ferrara, December 2017.

[8] F.Drui, E. Franck, P. Helluy, L. Navoret, *An analysis of over-relaxation in kinetic approximation*, Comptes Rendus Mécanique Volume 347, Issue 3, March 2019, Pages 259-269

[9] D. Coulette, E. Franck, P. Helluy, A. Ratnani, E. Sonnendrücker, *Implicit time schemes for compressible fluid models based on relaxation methods*, Computers and Fluids Volume 188, 30 June 2019, Pages 70-85.

[10] D. Coulette, E. Franck, P. Helluy, M. Mehrenberger, L. Navoret, *High-order implicit palindromic discontinuous Galerkin method for kinetic-relaxation approximation*, Computers and Fluids, Volume 190, 15 August 2019, Pages 485-502.

[11] D. Coulette, C. CourtËs, E. Franck, L. Navoret, *Vectorial kinetic relaxation model with central velocity. Application to implicit relaxations schemes*, Accepted in "Communications in Computational Physics".

Refereed proceedings

[12] C. Buet, B. Després, E. Franck, *Asymptotic Preserving Finite Volumes Discretization For non linear Moment Model On Unstructured Meshes*, Finite Volumes for Complex Applications VI, Springer Proceedings in Mathematics Volume 4, 2011, pp 467-474.

[13] E. Franck, P. Hoch, G. Samba, P. Navarro, *An asymptotic preserving scheme for P_1 model using classical diffusion schemes on unstructured polygonal meshes*, Cemracs 2010, ESAIM: Proceedings, Octobre 2011, Vol. 32,p. 56-75.

[14] B. Després (auteur principal), C. Buet and E. Franck, *A priori analysis of asymptotic preserving schemes with the modified equation*, Hyperbolic problems: theory, numerics and applications, AIMS on Applied Mathematics, vol 8, pp 501.

[15] E. Franck, *Modified Finite Volume Nodal Scheme for Euler Equations with Gravity and Friction*, Finite Volumes for Complex Applications VII-Methods and Theoretical Aspects Springer Proceedings in Mathematics and Statistics Volume 77, 2014, pp 285-292.

[16] A. Ratnani, B. Nkonga, E. Franck, A. Eksaeva, M. Kazakova, *Anisotropic diffusion in toroidal geometry*, ESAIM Proc, Volume 53, March 2016, pp 77-98.

[17] C. Courtès, E. Franck, P. Helluy and H. Oberlin, *Study of physic-based preconditioning with high order Galerkin method discretization for hyperbolic wave problems*, ESAIM: PROCEEDINGS AND SURVEYS, December 2016, Vol. 55, p. 61-82.

[18] D. Coulette, E. Franck, P. Helluy, M. Mehrenberger, L. Navoret, *Palindromic discontinuous Galerkin method*, FVCA 2017: Finite Volumes for Complex Applications VIII - Hyperbolic, Elliptic and Parabolic Problems, pp 171-178.

[19] J. Badwaik, M. Boileau, D. Coulette, E. Franck, P. Helluy, L. Mendoza, H. Oberlin, *Task-based parallelization of an implicit kinetic scheme*, ESAIM: ProcS Volume 63, 201, pp 60-77, 19 October 2018.

[20] C. Courtès, E. Franck, *Linear stability of a vectorial kinetic relaxation scheme with a central velocity*, Accepted in "HYP2018 proceedings".

Participation to Physical articles

[21] M. Bécoulet, F. Orain, X. Garbet, G. T. A Huijsmans, S. Pamela, P. Cahyna, M. Hölzl, E. Franck, E. Sonnendr¸cker, G. Dif-Pradalier, C. Passeron, G. Latu, J. Morales, E. Nardon, A. Fil, B. Nkonga, A. Ratnani, *Mechanism of Edge Localized Mode mitigation by Resonant Magnetic Perturbations*, Phys. Rev. Lett. 113, 155001, september 2014.

Submit papers

[21] E. Franck, L. Navoret, *Semi-implicit two-speed Well-Balanced relaxation scheme for Ripa model*, Submit in "FVCA9 proceedings".

[22] F. Bouchut, E. Franck, L. Navoret, *A low cost semi-implicit low-Mach relaxation scheme for the full Euler equations*, Submit in Journal Of Scientific Computing.

[23] R. HÈlie, P. Helluy, E. Franck, L. Navoret, *Kinetic over-relaxation method for the convection equation with Fourier solver*, Submit in "FVCA9 proceedings".

PhD thesis

[24] E. Franck *Design and numerical analysis of asymptotic preserving schemes on unstructured meshes. Applications to the linear transport and Friedrichs systems*, University Paris VI, CEA.

Contributions and Talks

Conference Talks

[1] *Asymptotic preserving scheme for two moment models on unstructured meshes* , CANUM 2010, Carcans-Maubuisson, June 2010.

[2] *Asymptotic preserving finite volumes scheme for the M_1 model of radiative transfer on unstructured meshes*, Finite Volumes For Complex Applications VI, Pragua, June 2011.

[3] *Asymptotic preserving finite volumes schemes P_n and S_n models in linear transport on unstructured meshes*, Numerical Approximations of Hyperbolic Systems with Source Terms and Applications 2012. Roscoff. September 2011.

[4] *Design and analysis of cell-centered finite volumes schemes in the diffusion limit on distorted meshes*, Numerical Approximations of Hyperbolic Systems with Source and Applications 2013 (NUMHYP 2013), Aachen, September 2013.

[5] *Modified nodal finite volume scheme for Euler equations with friction and gravity*, Finite Volumes For Complex Applications VII, Berlin, June 2014.

[6] *Preconditioning and nonlinear time solvers for the Jorek MHD code*, AIMS conférence, Madrid, July 2014.

[7] *Hierarchy of fluids model for plasma and Adaptive Physic-Based Preconditioning*, SMAI 2015, Karellis, June 2015.

[8] *Well balanced Finite volume scheme for Euler equations with external forces on unstructured meshes*, ENUMATH 2015, Ankara, September 2015.

[9] *Physic-based Preconditioning and multiscale elliptic operators for fluid models,*, Canum 2016, Obernai (France), May 2016.

[10] *Physic-based Preconditioning and B-Splines finite elements method for Tokamak MHD*, ECCOMAS 2016, Crete island, June 2016.

[11] *B-Splines Finite element and Physic-Based preconditioning for Tokamak Plasma*, Isogeometric and meshfree methods, San Diego, October 2016.

[12] *High order implicit scheme for hyperbolic systems*, ENUMATH 2017, Bergen, September 2017.

[13] *B-Splines compatible finite element spaces. Application to plasma physics*,Canum 2018, Cap d'adge, June 2018.

[14] *Implicit high-order relexation schemes. Application to plasma physics*, ApplMath18, Sibenik, September 2018.

[15] *Semi-implicit relaxation methods for low mach flows Talk*, ICIAM 2019, Valencia, July 2019.

[16] *Semi-implicit relaxation methods for low mach flows Talk*, Enumath 2019, Eggmond and Zee, September 2019.

Participation to research projects

[1] **EUROfusion Enabling Research Project (2014)**: *JOREK, BOUT++ non-linear MHD modelling of MHD instabilities and their control in existing tokamaks and ITER.*
Becoulet M., Orain F., Dif-Pradalier G., Latu G., Grandgirard V., Passeron C., Morales J., Nkonga B., Galligo A., Guillard H., Mourrain B., Ratnani A., Futatani S., Ramet P., Lacoste X., Hölzl M., Sonnendruecker E., Strumberger E., Franck E., Tichmann C., Pamela S., Wilson H., Dudson B., Imada K., Westerhof E., Pavel C., Lessig A.

[2] **EUROfusion Enabling Research Project (2015-2017)**: *Global non-linear MHD modeling in toroidal geometry of disruptions, edge localized modes, and techniques for their mitigation and suppression.*
Hoelzl M. (PI),Becoulet M., Sonnendruecker E., Strumberger E., Pautasso G., Ratnani A., Orain F., Nardon E., Dif-Pradalier G., Latu G., Grandgirard V., Passeron C., Morales J., Nkonga B., Guillard H., Sangam A., Franck E., Pamela S., Cahyna P., Seidl J., Futatani S., Westerhof E.

[3] **EXAMAG Project SPPEXA (2016-2018): Exascale simulations of the evolution of the universe including magnetic fields**, C. Klingenberg, G. Schnücke, P. Gallego, Y. Xia, V. Springel,K. Schaal, R. Pakmor, E. Franck, P. Helluy.

[4] **EUROfusion Enabling Research Project (2019-2020): Strengthening the non-linear MHD code JOREK for application to key questions of the fusion roadmap**, Hoelzl M. (PI), Huijsmans G.T.A., Atanasiu C.V., Bandaru V.K., Becoulet M., Bhole A., Cathey A., Dvornova A., Franck E., Futatani S., Guillard H., Latu G., Liu F., Nardon E., Nkonga B., Pamela S., Passeron C., Smith S., Strumberger E., van Vugt D.

[5] **Action Exploratoire INRIA" (2019-2022): MAchine LEarning for SImulation**, E. Franck (PI), H. Helluy, B. Naegel, L. Navoret, Y. Privat, V. Vigon. Beginning of 2020.

Teaching and Supervising

Teaching

[1] *Numerical methods for hyperbolic systems* : Exercises (master level), TUM, april-july 2013.

[2] *Advanced programmaing in C++* : Lectures, (bachelor level), Strasbourg university, january-may 2019.

[3] *Advanced programmaing in C++* : Lectures and Exercises, (bachelor level), Strasbourg university, january-may 2020.

Supervising

[1] Mustafa Gaja (Phd), December 2015-October 2019, IPP, *Implicit compatible finite element schemes for wave and fluid problems*, Co-supervisors: E. Sonnendrücker (Main supvervisor).

[2] Romane Helie (Phd), since october 2019, Strasbourg university, *Relaxation schemes for kinetic equations in Tokamaks*, Co-Supervisors: P. Helluy (main supervisor), L. Navoret.

[3] Jalal Lakhlili (Postdoctoral researcher), December 2015, IPP, *Parallelization, optimization and matrix-free methods for the Django-JOREK code*, Co-supervisors: E. Sonnendrücker (Main Supvervisor), A. Ratnani.

[4] David Coulette (Postdoctoral researcher), March 2016 - February 2018, IRMA Strasbourg, *Implicit scheme and LBM method*, Co-supervisors: P. Helluy (main supervisor).

[5] Laura Mendoza (Postdoctoral researcher), June 2017 - June 2018, IRMA Strasbourg, *Semi Lagrangian methods on block-structured meshes and relaxation methods*, Co-supervisors: P. Helluy (main supervisor).

[6] Clémentine CourtËs (Postdoctoral researcher), November 2017 - September 2018, IRMA Strasbourg, *Numerical methods for hyperbolic and dispersive PDE*, Co-supervisors: R. Cote.