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EMMANUEL FRANCK  
JUNIOR RESEARCHER INRIA

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Personal informations

**Nom** : Emmanuel Franck

**Âge** : 28 years, born the 21/05/1986, Paris

**Marital situation**: single

**Nationality** : French

<b>Contact</b> :	Professional IRMA Strasbourg 7 Rue René Descartes Strasbourg, France	Personal  11 rue Finkmatt Strasbourg, 67000, France
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Work experiences

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

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Formation

<i>2009-2012</i>	<b>PhD</b> in applied mathematics, CEA-DAM, UPMC.
<i>Supervisors</i>	Bruno Després, Christophe Buet
<i>Subject</i>	<i>Design and numerical analysis of asymptotic preserving schemes on unstructured meshes. Applications to the linear transport and Friedrichs systems.</i>
<i>Phd Defense</i>	17 october 2012
<i>Jury</i>	Christophe Berthon, Professor, University of Nantes François Bouchut, Senior researcher, 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
<i>2009</i>	<b>Master thesis</b> , CEA-DAM, UPMC.
<i>Supervisors</i>	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, windows
Informatic languages	Fortran 90, C, C++
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

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## PUBLICATIONS

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### 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).

### Refereed proceedings

- [5] 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.
- [6] 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.
- [7] 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.
- [8] 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.

### Participation to Physical articles

- [9] M. Bécoulet, F. Orain, X. Garbet, G. T. A Huijsmans, S. Pamela, P. Cahyna, M. Hölzl, E. Franck, E. Sonnendrücker, 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

- [10] C. Buet, B. Després, E. Franck, T. Leroy *Proof of uniform convergence for an asymptotic preserving discretization of the hyperbolic heat equation on general meshes*. Submit in Math. of Comp.
- [11] E. Franck, L. Mendoza *Finite volume scheme with local high order discretization of hydrostatic equilibrium for Euler equations with external forces*. Submit in Journal of Scientific Computing.
- [12] A. Ratnani, B. Nkonga, E. Franck, A. Eksaeva, M. Kazakova *Anisotropic diffusion in toroidal geometry*. Submit in ESAIM proceedings.

### Preprint and in preparation paper

- [13] E. Franck, A. Ratnani et E.Sonnendrücker, *Study of adaptive Physic Based preconditioning for stiff wave problems*. In preparation.

- [14] C. Courtes, E. Franck, P. Helluy, H. Guillard, H. Oberlin, *Finit element Physic Based preconditioning for DG hyperbolic solvers*. In preparation.

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### PhD thesis

- [14] 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.

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### Others

- [15] E. Franck, M. Hölzl, E. Sonnendrücker, Participation to the Oberwolfach workshop report, *Time implicit schemes for the JOREK MHD code: Newton procedure, continuation and preconditioning*.

The files are on the web page

<http://www.ipp.mpg.de/~emfra/>

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## CONTRIBUTIONS AND TALKS

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### Conference Talks

- [1] *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.
- [2] *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.
- [3] *Modified nodal finite volume scheme for Euler equations with friction and gravity*, Finite Volumes For Complex Applications VII, Berlin, June 2014.
- [4] *Preconditioning and nonlinear time solvers for the Jorek MHD code*, AIMS conférence, Madrid, July 2014.
- [5] *Hierarchy of fluids model for plasma and Adaptive Physic-Based Preconditioning*, SMAI 2015, Karellis, June 2015.
- [6] *Well balanced Finite volume scheme for Euler equations with external forces on unstructured meshes*, ENUMATH 2015, Ankara, September 2015.

### Workshop talks

- [7] *Asymptotic preserving schemes for moment models on unstructured meshes*, Workshop "advanced methods for the diffusion equation on general meshes", july 2010.
- [8] *Cell centered schemes with diffusion to solve the  $P_1$  systems on unstructured meshes*, CEMRACS, Luminy, august 2010.
- [9] *Cell-Centered Asymptotic preserving schemes for linear transport on unstructured meshes*, Workshop Asymptotic preserving schemes, Porquerolles, May 2012.
- [10] *Numerical issus for MHD Jorek code*, Workshop "Asymptotic and multiscale methods", Porquerolles, Juin 2013.
- [11] *Time implicit scheme for Jorek MHD code: Newton procedure, continuation and preconditioning*, Workshop "High-Resolution Mathematical and Numerical Analysis of Involution Constrained PDEs", Oberwolfach, September 2013.
- [12] *Adaptive Physic-Based Preconditioning for hyperbolic systems. Applications to wave and MHD models*, Workshop JOREK, Garching, May 2015.
- [13] *Adaptive physic based preconditioning for a linearized Discontinuous Galerkin Shallow water scheme*, Cemracs 2015, Luminy, July-August 2015.
- [14] *Django-Jorek code: a numerical box for MHD discretization and JOREK*, Workshop of IPL Fusion, october 2015.

### Seminary

- [15] *Asymptotic preserving schemes for two moments model on unstructured meshes*, PhD seminar of LJLL, UPMC, December 2010.
- [16] *Asymptotic preserving schemes for the numerical approximation of linear transport on unstructured meshes*, MIP seminar. University de Toulouse, december 2012.
- [17] *Asymptotic preserving schemes for hyperbolic systems on unstructured meshes*, LRC Manon seminar. UPMC, January 2012.

- [18] *Asymptotic preserving schemes for hyperbolic systems on unstructured meshes*, , CEA/DAM, March 2012.
- [19] *Asymptotic preserving schemes for linear transport on unstructured meshes*, NMPP seminar, Max-Planck Institut of Plasma Physics, June 2012.
- [20] *Numerical issues for the MHD Jorek code*, ITER seminar. UPMC, May 2013.
- [21] *Preconditioning and nonlinear time solvers for the Jorek MHD code*. IPP Theory seminar Usedom, November 2013.
- [22] *Design and numerical analysis of finite volume schemes in the diffusion regime on unstructured meshes*. Numerical analysis seminar, University of Lyon , February 2014.
- [23] *Preconditioning and nonlinear time solvers for the MHD Jorek code* . Seminar, University of Nice , March 2014.
- [24] *Finite volume methods for hyperbolic systems with source terms on general meshes*. Numerical method Seminar, University of Paris 6, LJLL, October 2014.
- [25] *Hierarchy of fluid models and numerical methods for the JOREK code*. ITER seminar, University of Paris 6, LJLL, October 2014.
- [26] *Hierarchy of fluid models and numerical methods for the JOREK code*. TONUS seminar, University of Strasbourg, November 2014.
- [27] *Physic-Based Preconditioning for stiff hyperbolic systems*. Seminar, Strasbourg, June 2015.
- [28] *Nodal finite volume schemes for hyperbolic systems with source terms on general meshes*. Cemracs 2015, Luminy, July August 2015.
- [27] *Numerical methods for edge instabilities in the Tokamak*. Strasbourg seminar, September 2015.
- [28] *Uniform asymptotic preserving and well balanced for hyperbolic systems with source terms*. University of Nantes, October 2015.

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## Posters

- [19] *Asymptotic preserving scheme for two moment models on unstructured meshes* , CANUM 2010, Carcans-Maubuisson, June 2010.
- [20] *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.

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## PARTICIPATION TO RESEARCH PROJECTS

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- [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.

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## TEACHING AND SUPERVISING

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### Teaching

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

### Supervising

- [1] Master thesis of Christelle Bordin (Strasbourg university), *Asymptotic and maximum principle finite preserving volume schemes for radiative transport equations.*