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Born on the 1st of June 1968 in Trier (Germany)  
French citizen  
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## 1 Vitae

- 1987–1990: Sup'aéro, french "Grande École" in Toulouse. Aeronautics engineering studies.
- 1990: Applied mathematics master's degree. University of Toulouse.
- 1990–1993: PhD "Numerical resolution of the harmonic Maxwell equations by a discontinuous finite elements method". Application to RADAR cross-section computations. ONERA (french aeronautics institute) in Toulouse.
- 1994–2006: Assistant professor at the University of Toulon.
- 2005: Habilitation thesis "Numerical simulation of multiphase flows. From theory to practice".
- since 2006: Full professor at the University of Strasbourg.

## 2 Research

I am interested in the mathematical and numerical modeling in physics. My researches are often connected to industrial problems and High Performance Computing (HPC).

### 2.1 Multiphase flows

Since 1999 my main research subject is related to the modeling of compressible multiphase flows. With my collaborators, I have developed models and methods for computing liquid flows with phase transitions [5], [26], liquid-gas flows [32], [13], particle-gas flows [11].

I have an experience of industrial contracts:

- in 1998, I made a coastal engineering study for the city of Banyuls-sur-Mer.
- in 2002, I developed a C++ finite volume software for the numerical simulation of a multiphase flow in a gas generator for the company "Direction des Constructions Navales" and the french Navy, in Toulon.
- in 2005-2006, I developed a parallel finite volume FORTRAN90/MPI software for the company "Principia" in La Ciotat, which is a subsidiary of AREVA. This software is devoted to turbulent multiphase compressible flows.

### 2.2 Plasma physics and HPC

Since 2007, I have started to work in plasma physics in the context of the International Thermonuclear Experimental Reactor (ITER) project. With Anaïs Crestetto, we have developed a software for coupling Discontinuous Galerkin and Particle-In-Cell methods. This software runs on GPU and is written in the OpenCL framework [17]. We are also studying reduced fluid models of the Vlasov-Maxwell kinetic model [9].

The Discontinuous Galerkin method will also be incorporated into a commercial software for electromagnetism modeling: this is a newly started collaboration with the company Axessim in Strasbourg.

## 2.3 Other works

I have also been interested in other subjects: theory of the compressible Navier-Stokes equations [12], boundary integral equations [25], inverse problems in underwater acoustics [31].

## 2.4 Main academic collaborations

Frédéric Coquel (Paris), Frédéric Golay (Toulon), Siegfried Müller (Aachen), Nicolas Seguin (Paris).

## 2.5 Main industrial collaborations

Jean-Marc Hérard (EDF, french electricity company), Christine de Jouët (PRINCIPIA), Christophe Girard (Axessim).

## 2.6 PhD

Sandra Rouy (1997–2000), Thomas Barberon (1999–2002), Julien Nussbaum (2004–2007), Hélène Mathis (2007–2010), Thomas Belat (since 2008), Anaïs Crestetto (since 2009), Jonathan Jung (since 2010), Thomas Strub (since 2011).

# 3 Teaching

I have now fifteen years experience in teaching mathematics and scientific computing to engineers and mathematics student from bachelor to master. Examples of courses: numerical analysis, scientific computing, partial differential equations, programming (FORTRAN, C, C++, OpenCL), functional and harmonic analysis, optimization, operations research, optimal control, finite volumes, finite elements, *etc.*

# 4 Others

- head of the team "Partial Differential Equations and Control Theory" at the mathematics institute of the University of Strasbourg.
- head of the "Scientific Computing" master's degree.
- french coordinator of the DFG/CNRS research group "Micro-Macro Modeling of Liquid-Vapor Flows". The german coordinator is Dietmar Kröner, Professor at the University of Freiburg.
- elected at the scientific council of the mathematics institute. Member of the "collegium science" of the University of Strasbourg.
- Organization of several scientific events. For instance, I recently organized, with other colleagues from Paris and Stuttgart, the CEMRACS 2011. It is a summer research school, which was held in Marseille in july and august 2011. It involved 150 participants and the subject was "Multiscale Coupling of Complex Models" <http://smai.emath.fr/cemracs/cemracs11/>.
- december 2011: fourth prize of the international AMD OpenCL innovation challenge. Numerical simulation of a medical X-ray generator on GPU. <http://community.topcoder.com/amdapp/2011/12/24/announcing-the-winners-of-the-innovation-challenge/>

# 5 Publications

## 5.1 Selected works

- [1] Philippe Helluy and Hélène Mathis. Pressure laws and fast legendre transform. *Math. Models Methods Appl. Sci.*, 21(4):745–775, 2011. <http://dx.doi.org/10.1142/S0218202511005209>
- [2] Thierry Gallouët, Philippe Helluy, Jean-Marc Hérard, and Julien Nussbaum. Hyperbolic relaxation models for granular flows. *M2AN Math. Model. Numer. Anal.*, 44(2):371–400, 2010. <http://dx.doi.org/10.1051/m2an/2010006>

- [3] Thomas Barberon and Philippe Helluy. Finite volume simulation of cavitating flows. *Computers and Fluids*, 34(7):832–858, 2005. <http://dx.doi.org/10.1016/j.compfluid.2004.06.004>
- [4] Thomas Barberon, Philippe Helluy, and Sandra Rouy. Practical computation of axisymmetrical multifluid flows. *Int. J. Finite Vol.*, 1(1):34, 2004. <http://www.ijfv.org/>

## 5.2 Other papers

- [5] Philippe Helluy, Jean-Marc Hérard, and Hélène Mathis. A well-balanced approximate riemann solver for compressible flows in variable cross-section ducts. *Journal of Computational and Applied Mathematics*, page 32, 2011. <http://dx.doi.org/10.1016/j.cam.2011.11.008>
- [6] Philippe Helluy, Jean-Marc Hérard, Helene Mathis, and Siegfried Müller. A simple parameter-free entropy correction for approximate riemann solvers. *Comptes Rendus Mécanique*, 338(9):493–498, 2010. <http://dx.doi.org/10.1007/s10494-006-9020-z>
- [7] Siegfried Müller, Philippe Helluy, and Josef Ballmann. Numerical simulation of a single bubble by compressible two-phase fluids. *Internat. J. Numer. Methods Fluids*, 62(6):591–631, 2010. <http://dx.doi.org/10.1002/flid.2033>
- [8] Christoph Altmann, Thomas Belat, Michael Gutnic, Philippe Helluy, Hélène Mathis, Éric Sonnendrücker, Wilfredo Angulo, and Jean-Marc Hérard. A local time-stepping discontinuous Galerkin algorithm for the MHD system. In *CEMRACS 2008—Modelling and numerical simulation of complex fluids*, volume 28 of *ESAIM Proc.*, pages 33–54. EDP Sci., Les Ulis, 2009. <http://dx.doi.org/10.1051/proc/2009038>
- [9] Frédéric Golay and Philippe Helluy. Numerical schemes for low Mach wave breaking. *Int. J. Comput. Fluid Dyn.*, 21(2):69–86, 2007. <http://dx.doi.org/10.1080/10618560701343382>
- [10] Frédéric Coquel, Philippe Helluy, and Jacques Schneider. Second-order entropy diminishing scheme for the Euler equations. *Internat. J. Numer. Methods Fluids*, 50(9):1029–1061, 2006. <http://dx.doi.org/10.1002/flid.1104>
- [11] Philippe Helluy and Frédéric Golay. Applications of the finite volumes method for complex flows: From the theory to the practice. *Flow, Turbulence and Combustion*, 76(4):315–329, 2006. <http://dx.doi.org/10.1007/s10494-006-9020-z>
- [12] Philippe Helluy and Nicolas Seguin. Relaxation models of phase transition flows. *M2AN Math. Model. Numer. Anal.*, 40(2):331–352, 2006. <http://dx.doi.org/10.1051/m2an:2006015>
- [13] Julien Nussbaum, Philippe Helluy, Jean-Marc Hérard, and Alain Carrière. Numerical simulations of gas-particle flows with combustion. *Flow, Turbulence and Combustion*, 76(4):403–417, 2006. <http://dx.doi.org/10.1007/s10494-006-9028-4>
- [14] Philippe Helluy, Frédéric Golay, Jean-Paul Caltagirone, Pierre Lubin, Stéphane Vincent, Deborah Drevard, Richard Marcer, Philippe Fraunié, Nicolas Seguin, Stephan Grilli, Anne-Cécile Lesage, Alain Dervieux, and Olivier Allain. Numerical simulations of wave breaking. *M2AN Math. Model. Numer. Anal.*, 39(3):591–607, 2005. <http://dx.doi.org/10.1051/m2an:2005024>
- [15] Jean-Claude Le Gac, Yann Stephan, Mark Asch, Philippe Helluy, and Jean-Pierre Hermand. A variational approach for geoacoustic inversion using adjoint modeling of a PE approximation model with non local impedance boundary conditions. In *Theoretical and computational acoustics 2003*, pages 254–263. World Sci. Publ., River Edge, NJ, 2004. <http://www-irma.u-strasbg.fr/~helluy/ADMIN/CV/acoustic2.pdf>
- [16] Philippe Helluy, Sylvain Maire, and Patrice Ravel. Intégration numérique d’ordre élevé de fonctions régulières ou singulières sur un intervalle. *C. R. Acad. Sci. Paris Sér. I Math.*, 327(9):843–848, 1998. [http://dx.doi.org/10.1016/S0764-4442\(99\)80116-5](http://dx.doi.org/10.1016/S0764-4442(99)80116-5)
- [17] Frédéric Golay and Philippe Helluy. Numerical simulation of viscous compressible fluid based on a splitting method. Publication de l’ANAM. <http://www-irma.u-strasbg.fr/~helluy/ADMIN/CV/nastocomp.pdf>, 1997

- [18] Philippe Helluy and Sandrine Dayma. Convergence d'une approximation discontinue des systèmes du premier ordre. *C. R. Acad. Sci. Paris Sér. I Math.*, 319(12):1331–1335, 1994. <http://www-irma.u-strasbg.fr/~helluy/ADMIN/CV/cras94.pdf>
- [19] Françoise Bourdel, Pierre Mazet, and Philippe Helluy. Resolution of the non-stationary or harmonic Maxwell equations by a discontinuous finite element method. application to an e.m.i. (electromagnetic impulse) case. In *10th international conference on computing methods in applied sciences and engineering, Paris, february 11-14*, pages 1–18. Nova Science Publishers, Inc., New York, 1992. <http://www-irma.u-strasbg.fr/~helluy/ADMIN/CV/inria92.pdf>

### 5.3 Proceedings

- [20] Anaïs Crestetto and Philippe Helluy. Water-bag model and method of moments for the Vlasov equation. In *Finite Volumes for Complex Applications 6*, pages 293–301. Springer, 2011
- [21] Philippe Helluy and Jonathan Jung. A well-balanced scheme for two-fluid flows in variable cross-section ducts. In *Finite Volumes for Complex Applications 6*, pages 561–569. Springer, 2011
- [22] Julien Nussbaum, Philippe Helluy, and Jean-Marc Herard. Multi-dimensional two-phase flow modeling applied to interior ballistics. *Journal of Applied Mechanics - Transactions of the ASME*, 78(5):9 pages, 2011. <http://dx.doi.org/10.1115/1.4004293>
- [23] Thierry Gallouët, Philippe Helluy, Jean-Marc Hérard, and Julien Nussbaum. A two-fluid model for dense granular flows. In *Finite volumes for complex applications V*, pages 439–446. ISTE, London, 2008
- [24] Philippe Helluy, Hélène Mathis, and Siegfried Müller. An ALE averaging approach for the computing of bubble oscillations. In *Finite volumes for complex applications V*, pages 487–494. ISTE, London, 2008
- [25] Thomas Barberon and Philippe Helluy. Finite volume simulations of cavitating flows. In *Finite volumes for complex applications, III (Porquerolles, 2002)*, pages 441–448. Hermes Sci. Publ., Paris, 2002
- [26] Mark Asch, Jean-Claude Le Gac, and Philippe Helluy. An adjoint method for geoacoustic inversions. In *2nd Conference on Inverse Problems, Control and Shape Optimization*. Carthage University, Tunisia, 2002. <http://www-irma.u-strasbg.fr/~helluy/ADMIN/CV/acoustic.pdf>
- [27] Philippe Helluy, Sylvain Maire, and Patrice Ravel. New higher order numeric quadratures for regular or singular functions on an interval, applications for the Helmholtz integral equation. In *Second Symposium on Multibody Dynamics and Vibration, september 12-16*. ASME, Las Vegas, Nevada, 1999. <http://www-irma.u-strasbg.fr/~helluy/ADMIN/CV/asme99.pdf>
- [28] Sandra Rouy and Philippe Helluy. Mathematical and numerical modeling of a two-phase flow by a level set method. In *Finite volumes for complex applications II*, pages 833–840. Hermes Sci. Publ., Paris, 1999
- [29] Philippe Helluy, Pierre Mazet, and Patricia Klotz. Sur une approximation en domaine non borné des équations de Maxwell instationnaires, comportements asymptotiques. *Rech. Aérospat.*, 5(5):365–377, 1994. <http://www-irma.u-strasbg.fr/~helluy/ADMIN/CV/aero94.pdf>
- [30] Philippe Helluy. Couplage équation intégrale-volumes finis pour la résolution des équations de Maxwell harmoniques. In *JEE'93, European symposium on numerical methods in electromagnetics, november 17-19th*, pages 217–226. ONERA, UPS, INSA, CERFACS, Toulouse, 1993. <http://www-irma.u-strasbg.fr/~helluy/ADMIN/CV/jeee93.pdf>

## 5.4 Other works

- [31] Philippe Helluy. A portable implementation of the radix sort algorithm in OpenCL. <http://hal.archives-ouvertes.fr/hal-00596730/fr/>, 2011
- [32] Mathieu Bachmann, Philippe Helluy, Hélène Mathis, and Siegfried Müller. Random sampling remap for compressible two-phase flows. <http://hal.archives-ouvertes.fr/hal-00546919/fr/>, 2010
- [33] Philippe Helluy. *Simulation numérique des écoulements multiphasiques: de la théorie aux applications*. PhD thesis, Université de Toulon, 2005. Habilitation thesis. <http://www-irma.u-strasbg.fr/~helluy/ADMIN/habilitation.pdf>
- [34] Philippe Helluy and Vincent Rey. Modélisation numérique de la houle dans le port de Banyuls. Technical report, ISITV, 1998. Contrat de recherche avec la Mairie de Banyuls-sur-mer. <http://www-irma.u-strasbg.fr/~helluy/ADMIN/CV/BANYULS.pdf>
- [35] Philippe Helluy. *Résolution numérique des équations de Maxwell harmoniques par une méthode d'éléments finis discontinus*. PhD thesis, Sup'aéro, janvier 1994. <http://www-irma.u-strasbg.fr/~helluy/ADMIN/CV/these-helluy.pdf>