Vincent Darrigrand

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Education

2013 - 2017 **Ph.D in Applied Mathematics**,
Co-tutelage between the University of the Basque Country, Spain and University of Pau, France,
PhD title: *Goal-Oriented Adaptivity using Unconventional Error Representation*,
Under supervision of Prof. David Pardo (Bilbao, Spain) and Prof. Hélène Barucq (Pau, France),
International collaborations: Prof. Serge Prudhomme (Polytechnique de Montréal, Montréal, Canada), Prof. Ignacio Muga (Pontificia Universidad Católica Valparaíso, Valparaíso, Chile), Prof. Albert Romkes (South Dakota School of Mines and Technology, Rapid City, USA).
Obtained with *cum laude* and International mentions

2010 - 2011 **Master degree in Mathematics with a specialty in Applied Analysis, Modelisation, Scientific Computing**,
University of Toulouse, France.

2009 - 2010 **Master degree in Mathematics with a speciality in mathematical engineering ("Agrégation of Mathématiques")**,
University of Toulouse, France.

2007 - 2008 **Graduation in Mathematics, Modelisation and Simulation**,
University of Pau, France.

2004 - 2007 **Bachelors Degree in Mathematics**,
University of Pau, France.

Working Experience

2020 - present **Post-Doctoral Researcher**,
IRIT-ENSEEIHT-CNRS, Toulouse, France.
Thematics: Linear Algebra, Direct Solver, Block Low Rank, MUMPS, HPC, Domain Decomposition

2019 - 2020 **Post-Doctoral Researcher**,
Cerfacs, team ALGO, Toulouse, France.
Thematics: Linear Algebra, Iterative Solver, Golub Kahan Bidiagonalization, HPC, Saddle-Point Problems, Structural Mechanics

2017 - 2019 **Post-Doctoral Researcher**,
University of the Basque Country, Bilbao
Basque Center for Applied Mathematics, Bilbao.
Thematics: Finite Elements, *hp*-adaptivity, Geophysics

2013 - 2017 **Predoctoral Researcher**,
University of the Basque Country and University of Pau.
Thematics: Finite Elements, *p*-adaptivity, Goal-Oriented Adaptivity, Geophysics

2014 - 2015 **ATER position (Temporary Assistant Teacher and Researcher)**,
University of Pau, France.

2011 - 2012 **Predoctoral Researcher**,
Basque Center for Applied Mathematics, Bilbao, Spain and University of Toulouse, France,
Collaboration in E.R.C. NUMERIWAVES project on control theory.

Research stays

2020 **University of the Basque Country**, *Bilbao, Spain*, 1 week, Invited,
Collaborations: D. Pardo.
Thematic: *hp*-Adaptivity

2019 **Polytechnic of Torino**, *Italy*, 1 week, Invited,
Collaborations: C. Canuto, M. Verani.
Thematic: *hp*-Adaptivity

2015-2016 **Catholic University of Valparaiso**, *Chili*, 6 months, GEAGAM European project,
Collaboration: I. Muga.
Thematic: *p*-Goal-Oriented Adaptivity

Main Computer Skills

Programming languages: Proficiency in Fortran and MATLAB.
Experience with Python, C/C++

HPC tools: Experience with PETSc and MUMPS
Experience with MPI/OpenMP.
Experience in numerical simulations on computational clusters (SLURM).

Software: Main developper of an *hp*-adaptive FEM package (Fortran, MPI, OpenMP, PETSc)

Others: Experience with Git.
Proficiency in LaTeX, and TiKZ/PGF.
Proficiency on MacOS and Linux environments.

Languages

French Mother Tongue

English Fluent *Cambridge's Advanced C1 certification*

Spanish Fluent *Cervantes institute's C1 certification*

Research Projects Membership

2018 - 2021 €765 000: RISE MATHROCKS Project -H2020 Programme- (PI: D. Pardo).

2017-2018 €75 000: MTM2016-81697-ERC -Research Project- (PI: D. Pardo).

2017 - 2019 €90 871: MTM2016-76329-R (AEI/FEDER, EU) -Research Project- (PI: D. Pardo).

2015 - 2017 €580 500: RISE GEAGAM Project -H2020 Programme- (PI: D. Pardo).

2014 - 2016 €47 955: MTM2013-40824-P -Research Project- (PI: D. Pardo).

2013 - 2018 €184 799: Consolidated Group on Mathematical Modeling, Simulation, and Industrial Applications (M2SI) IT649-13 (PI: D. Pardo).

Communications

Journal Articles (Peer-reviewed)

[1] Omella, Ángel Javier, Alvarez-Aramberri, Julen, Strugaru, Magdalena, **Darrigrand, Vincent**, Pardo, David, González, Héctor, and Santos, Carlos. **Jan. 2021**. "A simulation method for the computation of the effective P-wave velocity in heterogeneous rocks". In: *Computational Mechanics*. DOI: 10.1007/s00466-020-01966-3. HAL: https://hal.archives-ouvertes.fr/hal-03092551v1

[2] **Darrigrand, Vincent**, Pardo, David, Chaumont-Frelet, Théophile, Gómez-Revuelto, Ignacio, and Garcia-Castillo, Luis Emilio. **Oct. 2020**. "A painless automatic *hp*-adaptive strategy for elliptic problems". In: *Finite Elements in Analysis and Design* 178, p. 103424. DOI:

10.1016/j.finel.2020.103424. HAL: https://hal.archives-ouvertes.fr/hal-02071427v2

[3] Kruse, Carola, **Darrigrand, Vincent**, Tardieu, Nicolas, Arioli, Mario, and Rüde, Ulrich. **Nov. 2020**. "Application of an iterative Golub-Kahan algorithm to structural mechanics problems with multi-point constraints". In: *Advanced Modeling and Simulation in Engineering Sciences* 7.1. DOI: 10.1186/s40323-020-00181-2. HAL: https://hal.archives-ouvertes.fr/hal-03092469v1

[4] **Darrigrand, Vincent**, Rodríguez-Rozas, Ángel, Muga, Ignacio, Pardo, David, Romkes, Albert, and Prudhomme, Serge. **2018**. "Goal-oriented adaptivity using unconventional error representations for the multi-dimensional Helmholtz equation". In: *International Journal for Numerical Methods in Engineering* 113.1, pp. 22–42. ISSN: 1097-0207. DOI: 10.1002/nme.5601. HAL: https://hal.archives-ouvertes.fr/hal-01691495v1

[5] **Darrigrand, Vincent**, Pardo, David, and Muga, Ignacio. **2015**. "Goal-oriented adaptivity using unconventional error representations for the 1D Helmholtz equation". In: *Computers & Mathematics with Applications* 69.9, pp. 964–979. ISSN: 0898-1221. DOI: 10.1016/j.camwa.2015.03.006. HAL: https://hal.archives-ouvertes.fr/hal-01140748v1

Conference Proceedings (Peer-Reviewed)

[6] **Darrigrand, Vincent**, Rodríguez-Rozas, Ángel, Pardo, David, and Muga, Ignacio. **Aug. 2017**. "Goal-Oriented p-Adaptivity using Unconventional Error Representations for a 1D Steady State Convection-Diffusion Problem". In: *Procedia Computer Science* 108. International Conference on Computational Science, ICCS 2017, 12-14 June 2017, Zurich, Switzerland, pp. 848–856. ISSN: 1877-0509. DOI: 10.1016/j.procs.2017.05.168. HAL: https://hal.archives-ouvertes.fr/hal-01691499v1

Ph.D. Thesis

[7] **Darrigrand, Vincent**. **Sept. 2017**. "Goal-Oriented Adaptivity using Unconventional Error Representations". Doctoral Thesis supervised by Pardo, David and Barucq, Hélène. PhD thesis. University of the Basque Country (UPV) and University of Pau (UPPA). URL: http://www.theses.fr/2017PAUU3011. HAL: https://hal.archives-ouvertes.fr/tel-03092582

Works in Progress

[8] Arioli, Mario, **Darrigrand, Vincent**, Dumistrasc, Andrei, Kruse, Carola, and Ruede, Ulrich. **Dec. 2020**. "Inexact inner-outer Golub-Kahan Bidiagonalization method". In preparation.

[9] Caro, Felipe, **Darrigrand, Vincent**, Alberdi-Celaya, Elisabete, and Pardo, David. **Dec. 2020**. "A Painless Multi-level Automatic Goal-Oriented *hp*-Adaptive Coarsening Strategy". In preparation.

[10] **Darrigrand, Vincent**, Guignard, Diane, Kergrene, Kenan, Pardo, David, and Prudhomme, Serge. **Dec. 2020**. "Goal-Oriented Adaptivity: A comparative study of various decompositions of the error estimator". In preparation.

International Conferences

[1] Amestoy, P., Buttari, A., Darrigrand, V., L'Excellent, J.-Y., Mary, T., and Rouet, F.-H. **Mar. 2021**. *Block Low Rank Sparse Solvers for Challenging Computational Science Applications*. SIAM CSE 2021, Fort Worth, Texas, March 1-5, 2021. Speaker: J.-Y. L'Excellent.

[2] **Darrigrand, Vincent**, Pardo, David, Chaumont-Frelet, Théophile, Gómez-Revuelto, Ignacio, and Garcia-Castillo, Luis Emilio. **June 2019**. *A painless hp-adaptivity: Elliptic and non-elliptic problems*. ICCS 2019, Faro, Portugal. Speaker: Vincent Darrigrand.

[3] **Darrigrand, Vincent**, Pardo, David, Chaumont-Frelet, Théophile, Gómez-Revuelto, Ignacio, and Garcia-Castillo, Luis Emilio. **May 2019**. *A Painless Automatic Goal-Oriented hp-Adaptive Strategy for Elliptic Problems*. ADMOS 2019, El Campello, Spain. Speaker: Vincent Darrigrand.

[4] **Darrigrand, Vincent**, Pardo, David, Chaumont-Frelet, Théophile, Gómez-Revuelto, Ignacio, and Garcia-Castillo, Luis Emilio. **June 2019**. *A Painless Automatic Goal-Oriented hp-Adaptive Strategy for Non-Elliptic Problems*. MAFELAP 2019, Brunel, UK. Speaker: Vincent Darrigrand.

[5] Omella, Ángel Javier, Strugaru, Magdalena, Alvarez-Aramberri, Julen, **Darrigrand, Vincent**, Pardo, David, Santos, Carlos, and González, Hector. **July 2019**. *Low-frequency Upscaling of Effective Velocities in Heterogeneous Rocks*. International Conference on Computational Sciences (ICCS 2019). Faro, Portugal. Speaker: Ángel Javier Omella.

[6] Omella, Ángel Javier, Strugaru, Magdalena, Alvarez-Aramberri, Julen, **Darrigrand, Vincent**, Pardo, David, Santos, Carlos, and González, Hector. **July 2019**. *Upscaling effective compressional velocities of real rock samples.* International Congress on Industrial and Applied Mathematics (ICIAM 2019). Valencia, Spain. Speaker: Ángel Javier Omella.

[7] Pardo, David, Omella, Ángel Javier, Strugaru, Magdalena, Alvarez-Aramberri, Julen, **Darrigrand, Vincent**, Santos, Carlos, and González, Hector. **Sept. 2019**. *Effective compressional wave velocity estimation for porous rocks.* Dynamics, Equations and Applications (DEA 2019), Kraków, Poland. Speaker: David Pardo.

[8] **Darrigrand, Vincent**, Pardo, David, Chaumont-Frelet, Théophile, Muga, Ignacio, and Prudhomme, Serge. **July 2018**. *Goal-Oriented hp-Adaptivity using Unconventional Error Representations*. WCCM 2018, New-York, USA. Speaker: Vincent Darrigrand.

[9] Guignard, Diane, Prudhomme, Serge, **Darrigrand, Vincent**, Pardo, David, and Kergrene, Kenan. **July 2018**. *Adaptive Algorithm with Different Error Representations in Goal-Oriented Error Estimation*. WCCM 2018, New-York, USA. Speaker: Diane Guignard.

[10] **Darrigrand, Vincent**, Pardo, David, Muga, Ignacio, and Rodriguez-Rozas, Ángel. **June 2017**. *Goal-oriented p-adaptivity using unconventional error representations for a 1D steady state convection-diffusion problem.* ICCS 2017, Zurich, Switzerland. Speaker: Vincent Darrigrand.

[11] **Darrigrand, Vincent**, Pardo, David, Muga, Ignacio, Rodriguez-Rozas, Ángel, Romkes, Albert, and Prudhomme, Serge. **June 2017**. *Unconventional Error Representations for Goal Oriented p-Adaptivity and its Applications*. ADMOS 2017, Verbania, Italy. Speaker: Vincent Darrigrand.

[12] Prudhomme, Serge, Kergrene, Kenan, Guignard, Diane, Pardo, David, and **Darrigrand, Vincent**. **June 2017**. *Refinement indicators and adaptive schemes for goal-oriented error estimation*. ADMOS 2017, Verbania, Italy. Speaker: Serge Prudhomme.

[13] **Darrigrand, Vincent**, Pardo, David, Barucq, Hélène, Muga, Ignacio, and Rodriguez-Rozas, Ángel. **June 2016**. *Unconventional Error Representations for Goal-Oriented Adaptivity*. ICOSAHOM 2016, Rio de Janeiro, Brazil. Speaker: Vincent Darrigrand.

[14] **Darrigrand, Vincent**, Pardo, David, Muga, Ignacio, and Rodriguez-Rozas, Ángel. **July 2016**. *Unconventional Error Representations for Goal-Oriented Adaptivity*. WCCM XII & APCOM VI, Seoul, South Korea. Speaker: Vincent Darrigrand.

[15] **Darrigrand, Vincent**, Pardo, David, and Muga, Ignacio. **June 2015**. *Goal-Oriented Adaptivity using Unconventional Error Representations*. PANACM 2015, Buenos Aires, Argentina. Speaker: David pardo.

Seminars & Workshops

[1] **Darrigrand, Vincent**, Pardo, David, Chaumont-Frelet, Théophile, Gómez-Revuelto, Ignacio, and Garcia-Castillo, Luis Emilio. **May 2019**. *A painless hp-adaptivity: Elliptic and non-elliptic problems*. MATHROCKS 2019, UPC, Barcelona, Spain. Speaker: Vincent Darrigrand.

[2] Strugaru, Magdalena, Omella, Ángel Javier, Alvarez-Aramberri, Julen, Pardo, David, **Darrigrand, Vincent**, Santos, Carlos, and González, Hector. **May 2018**. *Computing Effective Velocities of Porous Rocks using a Finite Element Method and a Fast Marching Method*. Fifth International Workshop On Multiphysics, Multiscale, and Optimization Problems, BCAM, Bilbao, Spain. Speaker: Magdalena Strugaru.

[3] Alberdi, Elisabete, **Darrigrand, Vincent**, Muñoz, Judit, Pardo, David, Calo, Victor M., Rodríguez-Rozas, Ángel, and Muga, Ignacio. **May 2017**. *Pseudo-Dual Error Representations*

for Goal Oriented Adaptivity: Applications to Time-Domain and Helmholtz Problems. Workshop On Geophysical Application and HPC, Barcelona, Spain. Speaker: Elisabete Alberdi.

[4] **Darrigrand, Vincent**, Pardo, David, Muga, Ignacio, and Rodriguez-Rozas, Ángel. **May 2016**. *Generalised Error Representations for Goal-Oriented Adaptivity.* Seminar Caleta Numérica, Valparaiso, Chile. Speaker: Vincent Darrigrand.

[5] **Darrigrand, Vincent**, Pardo, David, and Muga, Ignacio. **May 2015**. *Goal-Oriented Adaptivity using Unconventional Error Representations.* Workshop on Advanced Subsurface Visualization Methods: "Exploring the Earth" 2015, Pau, France. Speaker: Vincent Darrigrand.

[6] **Darrigrand, Vincent**, Pardo, David, and Muga, Ignacio. **Mar. 2015**. *Goal-Oriented Adaptivity using Unconventional Error Representations for Wave Propagation Problems.* Seminar at Kaust, Saudi Arabia. Speaker: David Pardo.

[7] **Darrigrand, Vincent**, Pardo, David, and Muga, Ignacio. **May 2014**. *Goal-Oriented Adaptivity for Wave Propagation Problems using Multiple Dual Problems.* Third International Workshop On Multiphysics, Multiscale, and Optimization Problems, BCAM, Bilbao, Spain. Speaker: Vincent Darrigrand.

[8] Pardo, David, Alvarez-Aramberri, Julen, **Darrigrand, Vincent**, Bakr, Shaaban, and Torres-Verdin, Carlos. **May 2014**. *Fast Inversion of Alternate Current (AC) Geophysical Measurements.* Third International Workshop On Multiphysics, Multiscale, and Optimization Problems, BCAM, Bilbao Spain. Speaker: David Pardo.

Teaching

2016 Mini course (4h) : **Improving figures using TikZ/PGF for LaTeX: An Introduction.**
Valparaíso, Chile : May 2016.
Bilbao, Spain : May 2016.

2014-2015 ATER position: 192h (EqTD). *Pau, France*

Awards

2015 Best poster presentation for the doctoral school of University of Pau.
Goal-oriented adaptivity with multiple dual problems
University of Pau

Additional Training

2014-2015 University of Pau Doctoral school formations:
Coding the FEM (10h).
Tools for numerical simulations part 1 and 2 (10h).
Voice and gestures.
Cross-border Doctorials (University of Pau and University of the Basque country).

2012 Mathematical courses at BCAM (10 hours each),
Finite Dimensional optimal control: Theory, applications, numerical implementation.
Selected topics in the finite element analysis.
Topics on numerics for wave propagation.

Additional Information

2012 Creation and organisation of the student seminar. *BCAM, Bilbao, Spain.*