# Hammou EL-OTMANY

*PhD in Mathematics*

*25 Cours Leon Berard*
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## Research Interests

My specialization is numerical analysis, stochastic modelling and computational methods for inverse problems. My research lies within applied mathematics: modelling and numerical analysis (e.g. stochastic/deterministic modelling, theory and error analysis) goes hand in hand with practical development and implementation of robust, adaptive and efficient computational methods for inverse problems. Some of my work has applications in Computed Seismic Tomography, Fluid Mechanics and Phase Change Material.

## Info

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|---|---|
| Birth | August $15^{th}$, 1987 in Ksar Tassalehte |
| Marital status | Married with one child |
| Nationality | Moroccan |
| Website | `https://hamoelotmany.github.io/` |
| Email | hamou.elotmany@gmail.com |
| Skype | elotmany.hammou1 |

## Education and degrees

2012-2015 **PhD "Applied Mathematics"**, *Laboratory of Mathematics and its Applications of Pau, University of Pau*, Pau, France.

2011-2012 **Master's degree "Applied Mathematics option finance"**, *University of Marne-la-Vallée/Ecole des Ponts Paris-Tech*, Champs sur Marne, France.

2009-2011 **Engineer's degree "Actuarial and Financial sciences"**, *Faculty of Science and Technology-Guéliz*, Marrakech, Morocco.

2006-2009 **Bachelor's degree "Applied Mathematics"**, *Faculty of Science and Technology*, Errachidia, Morocco.

2006 **High school diploma "Experimental Sciences"**, *moulay-ali-cherif High school*, Errich, Morocco.

## Experiences

### Academic

November 2021-? **Self-Entrepreneur** , *Pau*, France.

April 2021-June 2021 **Teaching Assistant at IPSA** , *Ivry sur Seine*, France.

April 2019 - 2021 **Teaching Assistant and Former at Etud'+ Center** , *Morlaàs*, France.

Oct. 2015 - 2019 **Associate Research Scientist**, *Laboratory of Mathematics and its Applications of Pau, University of Pau*, Pau, France.

2017-2019 **Postdoctoral Fellow at CSTJF-Total/University of Pau**, *Pau*, France.

- Confidential Project: *Inverse problem for random field conditioning under connectivity constraints.*

- Supervisor: Philippe PONCET (Univ. Pau) and Tatiana CHUGUNOVA (Total).

2015-2017 **Postdoctoral Fellow at OPERA/ADERA**, *University of Pau*, Pau, France.

- Confidential Project: *Stochastic method to inverse problem for non-linear seismic tomography.*
- Supervisor: Reda BAINA (OPERA's Director).

2013-2015 **Teaching Assistant**, *University of Pau*, Pau, France.

2012-2015 **PhD "Applied Mathematics"**, *Laboratory of Mathematics and its Applications of Pau, University of Pau*, Pau, France.

- Thesis: Approximation by NXFEM method of interphase and interface problems in fluid mechanics.
- Advisors: Daniela CAPATINA and Didier GRAEBLING.

### Jury and Reviewers

- Adel BLOUZA, Univ. Rouen (Rev.)
- Didier GRAEBLING, Univ. of Pau
- Daniela CAPATINA, Univ. of Pau
- Patrick HILD, Univ. of Toulouse 3 (Rev.)
- Robert EYMARD, Univ. of Marne-la-Vallée (Exam.-Pres.)

2011-2012 **Master thesis at Laboratory CERMICS**, *Ecole des Ponts Paris-Tech*, Champs sur Marne, France.

- Title: *Second Order Backward SDEs and application in finance*
- Supervisors: Aurélien ALFONSI (CERMICS) and Damien LAMBERTON (UPMLV)

### Working

2010-2011 **Engineering thesis at Optima Finance Consulting (OFC)**, *Casablanca*, Morocco.

- Title: *Asset Liability Management (ALM): development of a financing strategy*
- Supervisors: Lahcen DOUGE (FST Marrakech) and Ali ALAMI IDRISSI (OFC).

2009-2010 **Intership at Ministry fo Economy, Finance and Administration Reform**, *Rabat*, Morocco.

- Title: *Statistical prediction to produce the FOGARIM product.*
- Supervisor: Hicham SOLHI (MEFAR, Morocco).

2009-2010 **Intership at OPTIMFX**, *Casablanca*, Morocco.

- Title: *Implementation and Calibration of the Extended Heston and the diffusion Models.*
- Supervisor: Said NASSIM (OPTIMFX).

### Supervising experiences

I was a mentor for graduate students (L3, M2).

March-June 2020 **Adel GAADAD**, *Student at M2, "Renewable Energy Engineering and Energy Efficiency"*, University of Sultan Moulay Slimane, Beni-Mellal, Morocco.

- Title: *Deep learning for opitimization the hybrid energy storage system.*
- Collaboration: Tarik KOUSKSOU (Prof. at Pau Univeristy), Tarik El-Rhafiki (Prof. at Taza University), Khaled ZADOUK (Prof. at Sultan Moulay Slimane Univeristy)

March-June 2019 **Said OUHAMOU**, *Student at M2, Applied Mathematics*, University of Moulay Ismail-Meknes, Morocco.

- Title: *Feynman-Kac probabilistic representations of non-linear partial differential equations in fluid Mecanics.*
- Collaboration: Mounir THAMI (Associate Professor).

March-June 2017 **Ilyes OHMICHA**, *Student at L3, Mathematics*, University of Moulay Ismail-Meknes, Morocco.

- Title: *Genetic algorithm for solving the problem of water flow and infiltration according to Green and Ampt.*
- Collaboration: Mounir THAMI (Associate Professor).

### Various

June 2019 **Visiting Fellow (one week) at the Faculty of Science, Univeristy of Moulay Ismail**, *Meknes*, Morocco.

- Invited by: Mounir THAMI (Associate Professor).
- Main activities: Stochastic modelling and Feynman-Kac probabilistic representations of non-linear partial differential equations.

June-July 2017 **Invited Fellow (two weeks) at Faculty of Science**, *Tetouan*, Morocco.

- Invited by: Abdellah TAZI (Professor).
- Main activities: Stochastic modelling and Feynman-Kac probabilistic representations of non-linear partial differential equations.

## Awards and Certifications

June 2011 **1st prize awareness of "Lauréat des ingénieurs"**, *Faculty of Science and Technology Marrakech, Morocco.*

September 2011 **Awards of excellence of "Labex Bezout Laboratory"**, *Univ. Marne-la-Vallée and Ecole des Ponts Paris-Tech.*

2011-2012 **Certificate of Bezout excellence program** , *University of Marne-la-Vallée/Ecole des Ponts Paris-Tech*, Champs sur Marne, France.

## Dissemination activities

September 2019 **Mini-course (3h) "Introduction to Machine Learning using Python"**, *ETUD'Plus Center, Morlaàs (France).*

June 2019 **Mini-course (3h) "Bayesian approach for inverse problem and applications"**, *Seminar for Master degree students, Moulay Ismail University (Morocco).*

## Responsabilities

### Institutional responsibilities

2013-2015 **Elected member of the Council**, *IPRA Research Federation*, University of Pau, Pau, France.

2013-2015 **Elected member of the Council**, *Laboratory of Mathematics and its Applications of Pau*, University of Pau, Pau, France.

2013-2014 **Co-organizer of the PhD math students seminar**, *Laboratory of Mathematics and its Applications of Pau*, University of Pau, Pau, France.

### Others responsibilities

2014-2015 **Co-author of the "guide des doctorants - ED211" books**, *Doctoral school*, Univeristy of Pau, Pau, France.

2013-2014 **Co-organizer of the research group for high school students (10 participants)**, *Laboratory of Mathematics and its Applications of Pau*, University of Pau, Pau, France.

2014-2015 **Mentor at CompaEtude (Courses and Supplementary exercices for Terminal S, CPGE, BAC+2)**, *Pau, France.*

## Publications and preprints

### Preprints

- H. El-Otmany. ***Investigation of a new stochastic viral infection model with general functional response***. Under reviewer in Chaos, Solitons & Fractals. Available here
- H. El-Otmany. ***A virtual class of nonconforming finite elements and its applications***. Under reviewer in AMC. Available here
- H. El-Otmany, T. Kousksou, T. El Rhafiki. ***Stochastic modeling for describing crystallization droplets in water emulsion***. Under reviewer in *Stochastic Processes and their Applications*. Available here

### Publications

- M.A. Bentaher, H. El-Otmany, T. Kousksou, T. El Rhafiki, Y. Zerouali. ***Inverse method to describe crystallization of undercooled water in cold storage tank***. *Journal of energy storage*, **36**, April 2021, 102404.
- H. El-Otmany, T. ElRhafiki, T.Kousksou, Y. Zeraouli. ***A Brownian motion model to describe a random crystallization of undercooled water dispersed within emulsions***. *Journal of energy storage*, **35**, March 2021, 102273, .
- Y. Khattari, H. El-Otmany, T. El Rhafiki, T. Kousksou, A.Ahmed, E. BenGhoula, ***Physical models to evaluate the performance of impure PCM dispersed in building materials***. *Journal of energy storage*, **31**, 1016612020, 2020. .
- D. Capatina, S.D. Santacreu, H. El-Otmany, D. Graebling. ***A Nitsche's Extended Finite Element Method for a nonconforming approximation for an interface problem***. *Mathematics and Computers in Simulation*, 137, pp. 226-245, **2017**. Available here.
- D. Capatina, S.D. Santacreu, H. El-Otmany, D. Graebling. ***Nonconforming finite element approximation for an elliptic interface problem with NXFEM method*** *Monografías matemáticas Garcia de Galdeano*, 40, pp. 43-52, **2015**. Available here.
- D. Capatina, N. Barrau, H. El-Otmany, R. Luce. ***Nitsche's Extended Finite Element Method for a Fracture Model in Porous Media***. *Journal of Applicable Analysis*, 95, pp. 2224-2242, **2015**. Available here.

### Posters

- D. Capatina, H. El-Otmany, D. Graebling. ***Numerical simulation of blood flow***. *Workshop at Pau University*, 2013. Available here.
- H. El-Otmany. ***New stochastic model for crystallization***, *Congres of Mathematical Modeling and Numerical Analysis at Moulay Ismail University*, Sept. 2019. Available here

### Manuscripts and Technical Reports

- Technical confidential report for Total: *Inverse problem for random field conditioning under connectivity constraints*, December **2018**.
- Technical confidential report for OPERA (Organisme Petrolier de Recherche Appliquée): *Stochastic method to inverse problem for non-linear seismic tomography*, February **2017**.
- PhD thesis manuscript: *Approximation by NXFEM method of interphase and interface problems in fluid mechanics*, November **2015**.
- Master's thesis manuscript: *Second Order BSDEs and application in finance*, June **2012**.

## Research activities

### Lectures in seminars and mini-courses

- H. El-Otmany. Analysis of stochastic model for crystallization in dispersed media within emulsion. Virtual seminary, collaboration group of Taz a(Maroc)-Pau (France), November 12, **2020**

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- H. El-Otmany, T. Kousksou, T. El Rhafiki. New stochastic model for crystalization in a dispersed medium. SIAM-University of Pau, February 04, **2020**
- H. El-Otmany, T. Kousksou, T. El Rhafiki. Comparison between MCMC methods and conjugate-gradient approaches for exploring parameter space of Heat inverse problem. SIAM-University of Pau, March 12, **2020**
- H. El-Otmany. Stochastic modelling and Feynman-Kac probabilistic representations of non-linear partial differential equations. Faculty of Science, Moulay Ismail Univeristy of Meknes, Morocco, June **2019**.
- H. El-Otmany. Stochastic modelling and Feynman-Kac probabilistic representations of non-linear PDE. Faculty of Science, Tetouan, Morocco, July **2017**.

## Talks in national and international conferences

- H. El-Otmany. ***A Nitsche's Extended Stochastic Finite Element Method for solving elliptic problem on random domains in porous media***, CIMMAN, Moulay Ismail University of Meknes (Morocco), September 16-18, **2019**.
- H. El-Otmany, R. Baina. ***Uncertainty quantification for inverse problem in seismic tomography***, OPERA (France), October 25, **2016**.
- D. Capatina, S.D. Santacreu, H. El-Otmany, D. Graebling. ***Robust NXFEM method for a nonconforming approximation for an elliptic problem***, $11^{th}$. World Congress on Computational Mechanics (WCCM XI) (mini-symposium), Barcelone (Espagne), July 20-25, **2014**.
- D. Capatina, H. El-Otmany, R. Luce. ***NXFEM for fracture model in porus media***, Semaine d'analyse numérique de Besançon : XFEM, Nitsche FEM, conditions aux limites artificielles, Besançon (France), June 15-19, **2015**.
- D. Capatina, S.D. Santacreu, H. El-Otmany, D. Graebling. ***Approximation par éléments finis non-conformes et NXFEM d'un problème de Stokes avec interface***, CANUM2015, Savoie (France), June 8-12, **2015**.
- D. Capatina, H. El-Otmany, D. Graebling, R. Luce. ***NXFEM for Darcy and Stokes interface problems with nonconforming finite elements***, MAMERN VI, Pau (France), June 1-5, **2015**.
- D. Capatina, S. D. Santacreu, H. El-Otmany, D. Graebling. ***Modélisation des globules rouges***. Journées du GDR Metice: Mathématiques Appliquées aux espèces, tissus et cellules, MAP5, Paris (France), November 19-20, **2014**.
- D. Capatina, N. Barreau, H. El-Otmany, R. Luce. ***NXFEM for solving non-standard transmission problems***, International Conference on Numerical and Mathematical Modeling of Flow and Transport in Porous Media, Dubrovnik (Croatia), Sept. 29 - October 03, **2014**.
- D. Capatina, S.D. Santacreu, H. El-Otmany, D. Graebling. ***Nonconforming finite element approximation for an elliptic interface problem with NXFEM method***, $13^{th}$. International Conference Zaragoza-Pau on Applied Mathematics, Jaca (Espagne), September 15-18, **2014**.
- D. Capatina, H. El-Otmany, D. Graebling. ***Numerical simulation of blood flow***, Journées de l'école doctorale de sciences ED211, University of Pau, June 05-06, **2014**.
- M. Eddahbi, H. El-Otmany. ***Approche asymptotique d'une EDP issue d'une équation différentielle stochastique rétrograde du second ordre***, Workshop International sur le Calcul Stochastique et ses Applications, Saida (Algeria), May 28-30, **2014**.
- D. Capatina, S.D. Santacreu, H. El-Otmany, D. Graebling. ***Modélisation du comportement de globules rouges dans un écoulement sanguin***, Journées Bordeaux-Pau-Toulouse, Anglet (France), September 19-20, **2013**.

## Talks in seminars or working groups

- D. Capatina, S.D. Santacreu, H. El-Otmany, D.Graebling. ***Nonconforming finite element approximation for an elliptic interface problem with NXFEM method***, Seminar of LMAP, september 09, **2014**.
- D. Capatina, S.D. Santacreu, H. El-Otmany, D. Graebling. ***Robust NXFEM method for a nonconforming approximation for an elliptic problem***, PhD seminar of LMAP, July 15, **2014**.
- D. Capatina, H. El-Otmany, D. Graebling. ***Simulation numérique d'écoulement des fluides biologiques***, Journées des doctorants du LMAP, University of Pau, July 03, **2014**.
- D. Capatina, H. El-Otmany, D. Graebling. ***Nitsche's Extended Finite Element Method (NXFEM) for an interface elliptic problem***, PhD seminar of LMAP, March 26, **2013**.

### Participation in conferences without presentation

- XFEM 2013 conference, ECCOMAS, Lyon (France), September 11-13, **2013**.
- Workshop On Stochastic Analysis and Applications to Finance, Marrakech (Morocco), May 31 to June 4, **2010**.
- ATTARAJI Forum on Trading and technic analysis, Agadir (Morocco), April 17, **2011**.

### Participation in intensive courses

- "Numerical analysis III", Roland BECKER, Univeristy of Pau, Pau (France), September 11-15, **2013**.
- "Numerical analysis of PDE" presented by Daniela CAPATINA, Univeristy of Pau, Pau (France), April 7-11, **2014**.
- "Machine Learning" presented by Stephane CLEMENÇON, Telecom Paris-Tech, Paris (France), January 6-9, **2020**.

## Teachning experiences

### Teaching assistant: University of Pau, Pau (128h, France)

2013-2014 ◦ **Analysis II**, *Tutorials*, L2 Maths.

> Sequences and series, Arithmetic series, Geometric series, convergence tests, (uniform, normal, absolute) convergences, Fourier series and integrals, applications of series.

◦ **Linear algebra I**, *Tutorials*, L1 Maths.

> Vectoriel space, linear mappins, Kernel and Image of linear map, Matrix Associated with a Linear Map, Determinants, Inverse of a Matrix, Cramer's Rule, Diagonalization of a Symmetric Linear Map, Polynomial space, Characteristic polynomial, Eigenvectors and Eigenvalues.

◦ **Function of two variables**, *Tutorials*, L1 MIASH.

> Review of function of one variable, Definitions and examples of functions with two variables, Limits and continuity, partial derivatives, tangent planes, graphic representation, linear approximation, chain rule, critical points, maximum and minimum values.

2014-2015 ◦ **Descriptive statistics**, *Tutorials and lab works (TD/TP)*, L1 Maths.

> Univariate analysis: definitions, numerical characterizations and graphics. Bivariate analysis: contingency tables and independence, linear regression and correlation coefficients of Bravais-Pearson and Spearman. Lab works over spreadsheet.

◦ **Sequences and functions**, *Tutorials*, L1 Maths.

> Sequences: Definitions and examples, Arithmetic and Geometric sequences, monotone convergence criterion, Cauchy convergence criterion, limits. Functions: functions and limits, (Uniform) Continuity, differentiable functions of one variable, Rolle's theorem, Hospital's Rule.

◦ **elementary algebra**, *Tutorials*, L1 MIASH and L1 Biology.

> Complex numbers, Polynomial space, Euclidean division, roots and theirs multiplicity, polynomial factorization, partial fraction decomposition, residue method, integration.

### Lecturer: ENCG, Kenitra (25h, Morocco)

2017-2018 ◦ **Optimization and Calibration of volatility models (12h)**, *Master of finance.*

> Overview of the models: Heston model, Bates model, NIG-CIR model. Option pricing with characteristic functions: Direct Integration and Gaussian quadratic. Model Calibration: Problem formulation, Particle swarm optimization, Genetic algorithm, Calibration of the Heston model.

◦ **Introduction to sctochastic calculus for finance (13h)**, *Master of finance.*

> A review of the basics on stochastic processes, Brownian motion, Stochastic integral and Itô's formula, Diffusion and Black-Scholes formula, Martingales and local martingales, Feynman-Kac formula, Martingale approach to Black-Scholes equation.

### Lecturer: Faculty of Science, Tetouan (12h, Morocco)

2019-2020 **Deterministic and stochastic optimizations**, *Lectures and tutorials*, Master of applied mathematics in finance.

> Introduction to inverse problem, deterministic inversion: Newton's method, conjugate gradient method, BFGS method. Stochastic inversion: Genetic algorithm, Bayesian approach, Prior and Posterior densities, marginal density, uncertainty quantification, applications.

### Teaching Assistant : courses taught at ETUD'+ Center, Morlaàs (140h, France)

2019-present **Sequences and limits**, *Lectures and tutorials*, IUT-STID (Univ. of Pau).

> Sequences: Definitions and examples, Arithmetic and Geometric sequences, monotone convergence criterion, Cauchy convergence criterion, limits.

**Time series**, *Lectures and tutorials*, IUT-STID (Univ. of Pau).

> Definition and examples, Trend, seasonality, cycles and residuals, Stationarity and Non-Stationarity process, linear filtering, exponential filtering, AR process, MA process, characteristic equation and its roots, Wold decomposition.

**Descriptive Statistics**, *Lectures and tutorials*, L1 and IUT-STID (Univ. of Pau).

> Univariate analysis: definitions, numerical characterizations and graphics. Bivariate analysis: contingency tables and independence, Chi-Square test, linear regression and correlation coefficients of Bravais-Pearson and Spearman.

**Introduction to probability**, *Tutorials*, IUT-STID (Univ. of Pau).

> Discrete probability: Random Experiments and Combinatorics, Discrete Random Variables, Conditional Probability, Independence, Bayes' Rule, Probability Mass Function, Expected value and Variance, Independent random variables. Continuous probability: Continuous random variables and their distributions, probability density function, Expected value and Variance.

**Linear algebra**, *Lectures and tutorials*, L1 and IUT-STID (Univ. of Pau).

> Matrices and Linear Equations: matrices, row operations and Gauss elimination. Vector Spaces: linear combinations, linear independence, dimension, rank. Linear Mappings: definition, Kernel and Image, rank and linear equations, matrix associated with a linear map. Determinants: determinants of order n, rank of a matrix and subdeterminants, Cramer's rule, inverse of a matrix. Eigenvectors and Eigenvalues: definitions, characteristic polynomial.

## Computer Skills

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|---|---|---|---|
| Languages | C++, Fortran, Java, HTML | Scripting | Python, Matlab |
| Visualisation | Gnuplot, Paraview, TecPlot | Statistics | R, SPSS, Eviews |
| Platforms | Linux, Mac Os, Windows | DB | SQL, MongoDB |
| Tools | Cmake, Git, LaTeX | | |

## Languages

Self-assessment European level CEFR (C2 maximum evaluation)

| | | **Understanding** | | **Speaking** | | **Writing** |
|---|---|---|---|---|---|---|
| | | Listening | Reading | Interaction | Production | |
| Tamazighte | Mother Tongue | *C2* | *C2* | *C2* | *C2* | *C2* |
| Arabic | Mother Tongue | *C2* | *C2* | *C2* | *C1* | *C1* |
| French | Fluent | *C2* | *C2* | *C2* | *C1* | *C1* |
| English | Advanced | *C2* | *C2* | *B2* | *B1* | *B1* |
| Spanish | Basic | *B2* | *B2* | *A2* | *A2* | *A1* |

## Interests and Hobbies

- Football
- Reading (Technical books& management)
- Drawing
- Organic agriculture