

CURRICULUM VITAE

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O. ROUSTANT

Personal data

- Born on 1973-07-10, at Montpellier (France). Married, 1 child.
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Education

- HDR in applied mathematics (Accreditation to supervise PhDs), 2011.
Qualified for the professor capacity by the French section 26 (Applied math.)
- PhD in financial mathematics, Univ. of Lyon, 2003.
- MSc in mathematics (algebra), Univ. of Lyon, 1996.
- Agrégation in mathematics (French competitive examination for education), 1995.

Employment

- 2019 - present: Full professor in applied mathematics at INSA Toulouse.
- 2016 - 2019: Full professor in applied mathematics at Mines Saint-Etienne (EMSE).
- 2002 - 2015: Associate professor in applied mathematics at EMSE.
- 1999 - 2002: Assistant in mathematics, EMSE.
- 1996 - 1999: Teacher in mathematics (military service, French high schools).

Duties, membership

- 2019 - : Associate editor of SIAM/ASA Journal on Uncertainty Quantification.
- 2009 - : Member of the Organizing committee of the French Research Group MASCOT-NUM, dealing with stochastic methods for the analysis of numerical codes.
- Member of the European Network for Business and Industrial Statistics (ENBIS).
- Member of the French Statistical Society (SFdS).

Awards

- Co-Winner of the 2013 ENBIS Greenfield Challenge with M. Lutz and E. Padonou
- Recipient of the 2010 ENBIS Young statistician award

Main activities (summary)

Academic research

Main research area: statistical learning, analysis of time-consuming computer codes (*computer experiments*). Publication of about thirty-five articles and a couple of R packages. Supervision of ten PhD thesis on this topic.

Collaborative research

Supervisor of the Chair in Applied Mathematics OQUAIDO (2016 - 2020), following DICE (2006 - 2009) and ReDICE consortiums (2011 - 2015), gathering six industrial and six academic partners around problems in computer experiments.

Courses and program responsibilities

Head at INSA of the double-degree program “ModIA” (Modélisation & Intelligence Artificielle), with INP-ENSEEIH school. Previously, at EMSE, head of the major “data science”, head of the master degree program “Applied Mathematics and Quantitative Finance” and coordinator of the double-degree program in Engineering & Actuarial sciences (with ISFA school). Courses at EMSE, Télécom Saint-Etienne, ISFA school, and abroad in Vietnam and Switzerland.

Event organization and diffusion

Co-chair of the international conferences MASCOT-NUM 2015 and ENBIS-EMSE 09 in computer experiments. Reinforcement of the link between ENBIS and SFdS through the organization of the special sessions “B&I Statistics in France” in ENBIS 2018 & 2011, and “ENBIS” in SFdS 2013. Popularization activities with La Rotonde.

Research activities

My research area is guided by data analysis, especially when only few data are available. In engineering, it often corresponds to complex systems physically modelled by time-consuming computer codes. In mathematics, it generates original questions in various domains including random field modelling, function approximation, multivariate analysis, design of experiments, optimization, . . . This domain is covered by the French research group MASCOT-NUM, the international community UCM (Uncertainty of Computer Models). It was a central topic of the thematic semester "Uncertainty quantification for complex systems" at Isaac Newton Institute (Cambridge, UK).

In this framework, my main research lines aim at answering several questions:

- How constructing faithful stochastic models (or metamodels) for small data?
- How quantifying the influence of inputs on the output of interest?
- How designing experiments (initially and sequentially)?
- How optimizing a multivariate function when only few observations are available?

I now briefly present them. Publications are listed at the end of the document.

Research lines

1. **Random field modelling.** We extend the scope of random field models, especially Gaussian processes, in order to incorporate prior knowledge and/or to fit specific constraints. We define new models by customizing covariance kernels and/or investigate their properties. Recent contributions deal with invariance properties (e.g. symmetry, additivity, harmonicity), inequality constraints (e.g. boundedness, monotonicity, convexity), non-Euclidean domains (e.g. the unit disk), and categorical inputs with a large number of levels.
2. **Global sensitivity analysis.** We explore the Sobol-Hoeffding decomposition from multiple angles: computational aspects, interaction analysis and problem-guided adaptations. Recent contributions include new sensitivity indices ('support indices'), a new class of kernels for random field models ('ANOVA' kernels), new theory in Poincaré inequalities and interaction analysis, and a new visualization tool for analyzing dependence in extremes ('tail dependograph').
3. **Design of experiments.** We investigate static and dynamic designs of experiments for function interpolation problems (computer experiments). New criterion and algorithms are defined, and their efficiency is explored mostly empirically. Nevertheless, some theory was possible for the extension of the famous EGO algorithm to general metamodels ('UP distribution'). Pursuing efforts on theory for dynamic designs of experiments is a natural future for this research line.
4. **Optimization.** We revisit mono- and multi- objective optimization problems when the number of evaluations is limited, including the case of Bayesian optimization. Original contributions are obtained by connecting these questions to other mathematical tools, such as zonotopes for high-dimensional problems, and random set theory and copulas for Pareto front estimation.
5. **Industrial statistics.** Part of my research is funded by CIFRE contracts or collaboration with partners from industry and technological research. These interactions between real-life problems are fruitful and nurtured several of my mathematical contributions, in modelling of course, but also in some unexpected areas such as functional inequalities and extremes.
6. **Econometrics.** This field is not really active now. It was the main topic of my PhD, where I investigated time series models for temperature, with application to finance / insurance.

5 selected research published papers

1. López-Lopera A. F., Bachoc F., Durrande N., Roustant O. (2018), “Finite-dimensional Gaussian approximation with linear inequality constraints”, *SIAM/ASA Journal on Uncertainty Quantification*, **6** (3), p. 1224-1255.

This research is motivated by an important issue in uncertainty quantification: accounting for inequality constraints, such as boundedness or monotonicity. In the PhD thesis of H. Maatouk that I supervised, a Gaussian random field (GRF) model was introduced, generalizing in a probabilistic framework the problem of spline approximation under inequality constraints.

Here, we provide several contributions to enhance the usage of that promising GRF model. First, we write the extension to general linear inequality constraints and provide a fast algorithm based on Hamiltonian Monte Carlo to simulate sample paths. Second, we theoretically investigate inference properties with maximum likelihood, accounting for inequality constraints. Next stage is to adapt the model for higher dimensions.

2. Roustant O., Barthe F., Iooss B. (2017), “Poincaré inequalities on intervals - application to sensitivity analysis”, *Electronic Journal of Statistics*, **11** (2), p. 3081-3119.

This research is an example of fruitful interactions between engineering and mathematics. Here a dimension reduction question led to new developments in functional inequalities, as well as a great improvement in the problem solving. The initial question was: "How to detect unessential input variables of a multivariate function, especially when the gradient is available"? In a previous work involving one of the co-author (B. Iooss), a connection was established between Poincaré inequalities on the real line. However, the inequalities were too large and sometimes useless.

In this article, we revisit Poincaré inequalities in order to find the (smallest) Poincaré constants for any (admissible) 1-dimensional probability distribution. We obtain new theoretical results for probability distributions on intervals, and semi-analytical expressions for some of them. We also investigate a general numerical method. On two hydraulic applications, these new findings provided 6 times sharper inequalities, which makes the technique applicable.

3. Padonou E., Roustant O. (2016), “Polar Gaussian Processes and Experimental Designs in Circular Domains”, *SIAM/ASA Journal on Uncertainty Quantification*, **4** (1), p. 1014-1033.

This research is motivated by an industrial question in microelectronics where spatial predictions on wafers (disks containing chips) do not account for prior knowledge on manufacturing operations such as rotations or diffusions from the center.

We address this question by customizing a Gaussian process (GP) model for that purpose. More precisely, we introduce so-called polar GPs on the unit disk, defined by combining covariance kernels for the radius and the angle. We compare several combining operations, and propose new experimental designs for circular domains. Polar GPs improve on standard kriging techniques (as well as Zernike polynomials on the disk) where radial/angular patterns are present, as for the motivating example. They are useful in more general contexts involving directional data, as shown on an environmental application.

4. Ginsbourger D., Roustant O., Durrande N. (2016), “On degeneracy and invariances of random fields paths with applications in Gaussian process modelling”, *Journal of Statistical Planning and Inference*, **170**, p. 117-128.

Accounting for prior knowledge is a crucial question in random field modelling. The starting point of this research is that many properties of random field paths can be rephrased as degeneracy/invariance properties of linear operators. This is the case, for instance, of sample paths which are additive, centered, harmonic or symmetric.

The main result is that degeneracy properties on sample paths are controlled by first and second moments. We provide several variations of this result in the Gaussian case with different settings: functional (RKHS), spectral (Karhunen-Loeve expansion) or probabilistic (Gaussian measures). Finally, we illustrate the benefits of accounting for sample path properties in Gaussian process regression, in terms of prediction accuracy.

5. Durrande D., Ginsbourger D., Roustant O., Carraro L. (2013), “ANOVA kernels and RKHS of zero mean functions for model-based sensitivity analysis”, *Journal of Multivariate Analysis*, **115**, p. 57-67.

Quantifying the importance of input variables and their interactions of a multivariate function can be done with the ANOVA decomposition. However, this is often computationally demanding, even for low order interactions, due to the recursive definition of the ANOVA terms.

In this research, the considered multivariate function is the posterior mean of a Gaussian process (GP), used in function approximation. By using the functional interpretation of GPs with reproducing kernel Hilbert spaces, we build a new class of kernels that allows computing any specific ANOVA term without recursion. The so-called ANOVA kernels are thus recommended to speed-up computations in global sensitivity analysis.

Collaborative research

- 2016 - 2020: Supervision of the Chair in applied mathematics OQUAIDO with N. Durrande (2016-2017) and R. Le Riche (2017-present). Research consortium in computer experiments, gathering 6 partners from technological research, and 6 partners from academia (150 k€/year).
- 2011 - 2015: ReDICE consortium (100 k€/ year). Participant.
- 2009 - 2012: SESAME project, funded by ADEME (20 ans de mesureS des retombEes AtMosphériquEs en France). Participant.
- 2006 - 2009: DICE consortium (150 k€/year). Leader of the subproject “Metamodels and Optimization”.
- 2005 - 2006: Research contract with IRSN, n. 11020496 (14 k€). Main investigator.
- 2004 - 2005: Research contract with IRSN (14 k€). Main investigator.

Organization of conferences and events

International conferences

I organized two international conferences:

- MASCOT-NUM 2015, on “Design and Analysis of Computer Experiments”. Co-chair with N. Durrande. Around 90 participants coming from 5 different countries.
- ENBIS-EMSE 2009, on “Design and Analysis of Computer Experiments”. Co-chair with D. Ginsbourger, in partnership with ENBIS. Around 60 participants coming from 8 different countries.

Events of the OQUAIDO Chair

Recall that the OQUAIDO Chair is a consortium gathering 6 partners from technological research and 6 from academia. It started in 2016 and will end at the end of 2020. I supervised the organization of 3-4 events / year from 2016 to 2019, consisting of *scientific meetings & training sessions* (30-40 participants). I was helped by the second coordinator of the Chair and one or two local organizers. I also organized 5 *research stay* invitations.

- *Training sessions* aim at upgrading all participants on a specific topic, either mathematical or in software. As an example, we organized sessions on “Stochastic simulators”, “Statistical methods for functional data”, “Statistics for extremes”, “From turnkey kriging to customized kernels.”.
- *Scientific meetings* combine internal presentations, showing the project activity, with talks from experts / invited speakers. During the first 4 years of the Chair, 110 communications were presented, 70 by Chair members, 20 by invited speakers and 20 invited posters. In addition to the 12 partners of the Chair, 15 other universities / companies took part at the scientific days.

- *Research stays* aim at fostering exchanges with international. Five senior researchers have been invited: J. Hensmann (Prowler.io, UK), H. Wynn (London School of Economics, UK), T. Santner (Ohio State Univ., US), G. Sagnol (TU Berlin, Germany) and P. Challenor (Exeter Univ., UK).

The full list of events is visible on the website of the Chair (oquaido.emse.fr). A midterm report can also be found there.

Events for ENBIS and SFdS networks

I fostered interaction between ENBIS and SFdS, by creating crossed sessions in their annual conferences. I organized the first ones in ENBIS 2011 and SFdS 2013. I participated to the scientific committee of ENBIS-11. Since then, I also organized a special session "Computer experiments" in ENBIS 2018 and I participated to the scientific committee of ENBIS-19 (see below).

Participation in scientific committees of international conferences

- ENBIS-19 conference.
- MASCOT-NUM 2019 conference.
- UCM 2012 conference, July 2-4, Sheffield (Great-Britain).
- ENBIS-11 conference, September 4-8, Coimbra (Portugal).
- ENBIS-DEINDE 2011 spring conference, March 16-18, Torino (Italy).

Reviewing

Reviewing of HDR and PhD thesis

I am called regularly to participate as a jury member in defenses of HDR (accreditation to supervise PhDs) and PhD thesis. I review 1 or 2 of them per year. As an example, in 2018 I reviewed the PhD thesis of Mona Abtini and Mathieu Carmassi, in 2017 the HDR of Maurizio Filippone, and in 2016 the PhD thesis of Ibrahima Niang and Laurent Gilquin.

Reviewing for journals

I served as a reviewer for (list by alphabetical order):

Applied Stochastic Models for Business & Industry, Annales de la Faculté de Sciences de Toulouse, Annals of Applied Statistics, Annals of Statistics, Electronic Journal of Statistics, ESAIM: Probability and Statistics, Journal of Statistical Computation & Simulation, Journal of Statistical Software, Quality & Reliability Engineering International, Reliability Engineering & System Safety, Review of Economics and Statistics, SIAM/ASA Journal on Uncertainty Quantification, Statistical Papers, Statistics & Computing, Structural and Multidisciplinary Optimization, Vietnamese Journal of Mathematics, ...

Doctoral studies

From 2013 to 2019, I was representative for the discipline Applied mathematics at EMSE for the doctoral school ED SIS 488.

PhD supervision

As a director

- Amine Aziz-Alaoui (2021 -).
PhD topic: Multidisciplinary optimization under uncertainty.
Funded by IRT Saint-Exupéry. Directed with M. de Lozzo (IRT Saint-Exupéry).

- Iain Henderson (2020 -).
PhD topic: Improvement of flooding simulators by mixing statistics and physics.
Funded by SHOM. Directed with P. Noble (INSA Toulouse).
- Jhouben Cuesta-Ramirez (2018 -).
PhD topic: Optimization of a computationally expensive simulator with quantitative and qualitative inputs.
Funded by CEA. Directed with A. Glière (CEA), G. Perrin (CEA) and R. Le Riche (EMSE).
- Tran Vi-vi Elodie Perrin (2017 - 2021, May 12).
PhD thesis: “Méta-modélisation et analyse de sensibilité pour les modèles avec sortie spatiale. Application aux modèles de submersion marine.”
Funded by BRGM and CCR. Directed with J. Rohmer (BRGM) and D. Moncoulon (CCR).
- Andrés López Lopera (2016 - 2019, September 19). Now post-doc at BRGM & Institut de Mathématiques de Toulouse.
PhD thesis: “Gaussian Process Modelling under Inequality Constraints”.
Funded by the Chair in Applied Math. OQUAIDO. Directed with N. Durrande (EMSE) and F. Bachoc (Inst. de Math. de Toulouse).
- Malek Ben Salem (2015 - 2018, March 19). Now research engineer at Ansys.
PhD thesis: “Model selection and adaptive sampling in surrogate modelling: Kriging and beyond”.
Funded by Ansys (CIFRE contract). Directed with F. Gamboa (Co-Dir., Inst. de Math. de Toulouse), L. Tomaso (Ansys).
- Espéran Padonou (2013 - 2016, May 13). Now head of the Fondation Vallet.
PhD thesis: “Statistical learning on circular domains for advanced process control in microelectronics”.
Funded by STMicroelectronics (CIFRE contract). Directed with J. Blue (EMSE), H. Duverneuil (STMicroelectronics).
- Mickaël Binois (2013 - 2015, December 3). Now researcher at INRIA.
PhD thesis: “High-dimensional multi-objective optimization for automotive design.”
Funded by Renault (CIFRE contract). Directed with D. Ginsbourger (Co-Dir., Univ. Berne), F. Mercier (Renault).
- Hassan Maatouk (2012 - 2015, October 1). First job after PhD: post-doc at INRIA.
PhD thesis: “Correspondance entre régression par processus gaussien et splines d’interpolation sous contraintes linéaires de type inégalité. Théorie et applications.”
Funded by St-Etienne doctoral school. Directed with L. Grammont (Co-Dir., Univ. Jean Monnet), X. Bay (EMSE), Y. Richet (IRSN).
- Jana Fruth (2012 - 2015, March 12). Now statistician.
PhD thesis: “New methods for the sensitivity analysis of black-box functions with an application to sheet metal forming”.
Cotutelle with University of Dortmund. Directed with S. Kuhnt (Co-Dir., Univ. Dortmund).

As a member of the supervision team

- Michel Lutz (2010 - 2013 May 14). Now “group data officer” at Total.
PhD thesis: “Méthodes socio-statistiques pour l’aide à la décision en milieu industriel”.
Funded by STMicroelectronics (CIFRE contract). Sup.: X. Boucher (Dir., EMSE), M.A. Girard (EMSE), O. Roustant.
- Nicolas Durrande (2008 - 2011 November 9). Now researcher at Prowler.io.
PhD thesis: “Etude de classes de noyaux adaptées à la simplification et à l’interprétation des modèles d’approximation. Une approche fonctionnelle et probabiliste”.
Funded by EMSE. Sup.: R. Le Riche (Dir., EMSE), L. Carraro (Dir., Telecom St-Etienne), D. Ginsbourger (Univ. of Bern), O. Roustant.

- Victor Picheny (2006 - 2009 October 15). Now researcher at Prowler.io.
PhD thesis: “Improving accuracy and compensating for uncertainty in surrogate-modelling”.
Cotutelle between EMSE and University of Florida (UF). Sup.: R. Haftka (Dir., UF), A. Vautrin (Dir., EMSE), N.-H. Kim (UF), G. Panasenko (Univ. J. Monnet), O. Roustant.
- David Ginsbourger (2006 - 2009 March 26). Now titular Professor at University of Bern & senior researcher at IDIAP.
PhD thesis: “Multiples Métamodèles pour l’Approximation et l’Optimisation de Fonctions Numériques Multivariables”.
Funded by the DICE consortium. Sup.: A. Antoniadis (Dir., Univ. J. Fourier), L. Carraro (EMSE), R. Le Riche (EMSE), O. Roustant.

Invited talks

Below the invitations as a speaker for plenary conferences or seminars.

- 2021 *Journée ‘Surrogate Day’*, Toulouse, July 1.
- 2020 *Journée OpenTURNS*, EDF Campus, Paris Saclay, June 5.
- 2019 (with E. Padonou) “Gaussian process modeling and process control on a disk”, *17th Workshop on Quality Improvement Methods*, TU Dortmund, June, 14-15.
- 2018 “(Meta)modelling with Gaussian processes: An overview”, *50èmes Journées de Statistiques, SFdS*, Saclay, May 28 - June 1.
- 2018 “Group covariance functions for Gaussian process metamodels with categorical inputs”, *Surrogate models for UQ in complex systems*, *Isaac Newton Institute for Mathematical Science*, Cambridge, February 5-9.
- 2018 –, Seminar of statistics, *Institut de Mathématiques de Toulouse*, June 11.
- 2018 –, Seminar of probability & statistics, *University of Montpellier*, October 15.
- 2017 “Les inégalités de Poincaré revisitées pour la réduction de dimension”, *Seminar of ISFA*, Lyon, March 10.
- 2016 (with F. Barthe) “Excursion in 1-dimensional Poincaré inequalities for global sensitivity analysis”, *Journées du GdR MASCOT NUM*, Toulouse, March 23-25.
- 2015 “Inequality constraints, support analysis and uncertainty quantification”, *workshop on ‘Uncertainty Quantification’*, *Louis Bachelier labex*, Institut Henri Poincaré, Paris, December 11.
- 2015 “Predicting on circular domains with Gaussian processes”, Seminar at TU Dortmund, March 10.
- 2014 (with Y. Deville) “(Re)Dice* pour les computer experiments”, *Troisièmes rencontres R*, Montpellier, June 25-27.
- 2013 “Krigage et analyse de sensibilité”, *Rencontres statistiques lyonnaises*, Université Claude Bernard Lyon 1, February 12.
- 2012 “Block-Additive kernels and other contributions in computer experiments”, *Journées du GdR MASCOT NUM*, Bruyères-le-Châtel, March 21-23.
- 2011 “Total interaction indices, FANOVA graphs, and application to the decomposition of functions with high complexity”, *Seminar of Institut de Mathématique de Toulouse*, October 18.
- 2011 “Data-driven Kriging models based on FANOVA decomposition”, Seminar of *Technische Universität Dortmund*, February 15.

- 2010 “Some research results of the DICE project”, *UCM 2010 conference*, Sheffield (Great-Britain), July 14.
- 2010 “A new statistical and graphical tool for selecting space-filling designs in computer experiments”, seminar at *Laboratoire Jean Kuntzmann, Université de Grenoble*, February 11.
- 2009 “Analytical computation of Sobol indices with a Gaussian process metamodel”, *6th Autumn Symposium of the Research Training Group “Statistical Modelling”, Technische Universität Dortmund* (Germany), November 20-21.
- 2009 (with D. Ginsbourger) “Carrying out Kriging-based techniques for prediction and optimization”, *EURISBIS’09 Conference*, Santa Margherita de Pula, Sardinia, Italy, June 1.
- 2009 (with D. Ginsbourger) “Kriging modelling for the analysis of simulators - Applications”, *Seminar of Université Catholique de Louvain*, May 5.
- 2007 (with L. Carraro and X. Bay) “Introduction aux RKHS”, *Journées du GdR MASCOT NUM*, Solaize, March 22-23.
- 2006 “Modélisation statistique de la température pour la gestion des produits dérivés climatiques”, *Journées de la Société Française de Statistique*, Clamart (France), May 29 - June 2.
- 2004 “Modélisation statistique de la température pour l’évaluation des produits dérivés climatiques: état des lieux, limites et perspectives”, *Journée de la Société Française de Statistique : “Dérivés climatiques”*, Paris (France), January 29.
- 2000 “Modélisation de la température”, *Colloque ISFA, “Couverture des risques naturels et climatiques, Approche technique”*, Paris (France), October 24-25.

Invitations for a research stay

- Isaac Newton Institute for Mathematical Science, Cambridge (UK): 1 month in 2018.
- Univ. of Dortmund, Germany (1 week stays): 2009, 2011, 2013, 2015.
- Univ. of Bern, Switzerland (1 week stays): 2010, 2011, 2013.
- Univ. of Sheffield, UK (1 week stay): 2012.

Teaching activities

My duties concerning teaching can be divided between responsibilities, teaching, pedagogy, popularization, project supervision (individual/class). I briefly present the main ones below.

Graduate program responsibilities

- 2014 - 2019: Major “Data Science” (M1-M2, 160h, 30 students). Construction and steering.
- 2008 - 2014: Master degree program “Applied Mathematics & Quantitative Finance” (M2, 360h, 20 students), in partnership with the Master of Science “Mathematical modelisation and applications”, Univ. Jean Monnet (St-Etienne). Construction and steering.
- 2003 - 2014: Master double-degree program Science and Engineering & Actuarial Sciences, in partnership with Institut de Science Financière et d’Assurances (ISFA), Lyon (6-8 students per year). Steering.
- 2003 - 2006: “Statistical methods and applications” (M1, 120h, 30-40 students). Steering.

Courses

I have been teaching mathematics for engineers, from L3 to M2 (master level), from basics in probability and statistics or numerical analysis to more advanced concepts such as stochastic calculus or functional data. Below, Table 1 presents my main course responsibilities and participations to external classes.

Pedagogical activities

In addition to traditional courses and labs, I have successfully experimented class projects guided by real-life applications. A first example is the IMT-Total challenge in data sciences, created with Michel Lutz at Total. It is a pedagogical challenge opened to the students of Mines-Telecom Institute. Prizes consist of internships at Total. The winners are selected in a two-stage procedure including the evaluation of a technical report explaining their methodology. The project has been presented at a French conference of pedagogy:

- Roustant O., Lutz M. (2019), Un exemple de compétition pédagogique en science des données, Colloque Francophone International sur l’Enseignement de la Statistique (CFIES), Strasbourg, September 25-27.

Two other projects were presented in the Francophone workshop on pedagogy at University: *Questions de pédagogie dans l’enseignement supérieur*. They address two main questions:

1. How to read efficiently a reference book in statistical learning? Roustant O., Badea A. (2015), "Un APP avec transmission croisée visant à s’appropriier un ouvrage de référence", proceedings of the 8th colloquium *Questions de pédagogie dans l’enseignement supérieur*, Brest, June 17-19.
2. How to integrate disciplinary knowledge to solve a real-life problem? Roustant O., Carraro L., Rodriguez R. (2007), "Un exemple de pré-projet à trois acteurs en école d’ingénieur", proceedings of the 4th colloquium *Questions de pédagogie dans l’enseignement supérieur*, Louvain-la-neuve (Belgium), January 24-26.

Popularization

- Consultant for the class project *Mathematics and Architecture* at Lycée H. d’Urfé, St-Etienne, with the science center La Rotonde, 2018.
- Consultant for the work group Enig’mathique at collège de Veauche, *Which ball for the World Cup 2014?*, with the science center La Rotonde.

Table 1: Course responsibilities

Name	Level	Students	Length
<i>INSA Toulouse</i>			
Computer experiments	M2	45	24h
Exploration and statistical software	M1	28	50h
<i>Mines St-Etienne</i>			
Functional data analysis	M1	40	15h
Global sensitivity analysis	M2	40	12h
Gaussian processes and metamodeling	M2	40	15h
Stochastic processes, stoc. calculus	M2	15	24h
GARCH models	M2	15	12h
Functions approximation, RKHS	M2	15	15h
Gaussian vectors	M1	35	18h
Time series	M1	35	18h
Pedagogical project	M1	35	20h
Design of experiments	M1	35	15h
Probability and Statistics	L3	120	45h
<i>ISFA - University of Lyon</i>			
Time series	M2	30	18h
<i>ISFA - Universities of Hanoi and Ho Chi Minh (Vietnam)</i>			
Stochastic Processes	M2	10	20h
Time Series	M2	10	20h

Participation to other courses (examples)

<i>University of Bern (Switzerland)</i>			
Time Series (computer labs)	M	10	8h
<i>Télécom St-Etienne</i>			
Proba.-Stat., linear model	L3	120	45h

Table 2: Main course responsibilities

- Videos and interviews with the science center La Rotonde.

Research output

Preprints submitted for publication

- SUBM 1. Bachoc F., Lopez-Lopéra A. F., Roustant O. (+2021), “Sequential construction and dimension reduction of Gaussian processes under inequality constraints”, in revision for *SIAM Journal on Mathematics of Data Science*.
- SUBM 2. Rohmer J., Roustant O., Lecacheux S., Manceau J.-C. (+2021), “Revealing the dependence structure of scenario-like inputs in numerical environmental simulations using Gaussian Process regression”, in revision for *Environmental Modelling and Software*.
- SUBM 3. Mercadier C., Roustant O., Genest C. (+2021), “A link between the Hoeffding-Sobol and Möbius decompositions”.
- SUBM 4. Lüthen N., Roustant O., Gamboa F., Iooss B., Marelli S., Sudret B. (+2021), “Global sensitivity analysis using derivative-based sparse Poincaré chaos expansions”.

Publications in peer-reviewed journals, and in the proceedings of international conferences

Publications in peer-reviewed journals

- PUBL 37. Perrin T.V.E., Roustant O., Rohmer J., Alata O., Naulin J.P., Idier D., Pedreros R., Moncoulon D., Tinarid P. (2021), “Functional principal component analysis for global sensitivity analysis of model with spatial output”, to appear in *Reliability Engineering & System Safety*, **211**.
- PUBL 36. Roustant O., Padonou E., Deville Y., Clément A., Perrin G., Giorla J., Wynn H. (2020), “Group kernels for Gaussian process metamodels with categorical inputs”, *SIAM/ASA Journal on Uncertainty Quantification*, **8**(2), p. 775-806.
- PUBL 35. Binois M., Ginsbourger D., Roustant O. (2020), “On the choice of the low-dimensional domain for global optimization via random embeddings”, *Journal of Global Optimization*, **76**(1), p. 69-90.
- PUBL 34. Roustant O., Gamboa F., Iooss B. (2020), “Parseval inequalities and lower bounds for variance-based sensitivity indices”, *Electronic Journal of Statistics*, **14**(1), p. 386-412.
- PUBL 33. Ben Salem M., Bachoc F., Roustant O., Gamboa F., Tomaso L. (2019), “Gaussian process-based dimension reduction for goal-oriented sequential design”, *SIAM/ASA Journal on Uncertainty Quantification*, **7**(4), p. 1369-1397.
- PUBL 32. Fruth J., Roustant O., Kuhnt S. (2019), “Support indices: Measuring the effects of input variables over their support”, *Reliability Engineering & System Safety*, **187**, p. 17-27.
- PUBL 31. Mercadier C., Roustant O. (2019), “The Hoeffding-Sobol decomposition in extreme value theory. Exploring the asymptotic dependence structure”, *Extremes*, **22** (2), p. 343-372.
- PUBL 30. López-Lopera A. F., Bachoc F., Durrande N., Roustant O. (2018), “Finite-dimensional Gaussian approximation with linear inequality constraints”, *SIAM/ASA Journal on Uncertainty Quantification*, **6** (3), p. 1224-1255.
- PUBL 29. Ben Salem M., Roustant O., Gamboa F., Tomaso L. (2017), “Universal Prediction Distribution for Surrogate Models”, *SIAM/ASA Journal on Uncertainty Quantification*, **5** (1), p. 1086-1109.
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