Detailed

Curriculum Vitæ

Dr. Stefano Marelli

Chair of Risk, Safety and Uncertainty Quantification

ETH Zürich

February 7, 2022

Contents

1 Curriculum vitæ

Personal information

Surname:	Marelli
Name:	Stefano
Date of birth:	June 23, 1981 – Sesto San Giovanni (Milano, Italy)
Nationality:	Italian

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ETH Zürich
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Current position

Since June 2018 — **Senior Scientist, Lecturer** (tenured), *Chair of Risk, Safety and Uncertainty Quantification, Institute of Structural Engineering*, ETH Zürich.

- Deputy lead of the Chair (e.g. during 2020 Sabbatical from Prof. Sudret)
- Independent supervision of internal and external (international) collaborations
- Supervision of PhD students and postdocs
- Teaching MSc, PhD and MAS/CAS courses
- Invited lecturer in summer schools/workshops
- Fundraising (SNF, EU, ETH- grants)

Work experience

2016–2018 **Oberassistent II (Senior assistant, lecturer)**, *Chair of Risk, Safety and Uncertainty Quantification, Institute of Structural Engineering*, ETH Zürich.

- Supervision of PhD students and postdocs
- Teaching several courses and block-courses at the 50-100% level
- Invited lecturer in summer schools/workshops
- Fundraising (SNF, ETH Risk-center, H2020)

2013–2016 **Oberassistent I (Senior assistant)**, *Chair of Risk, Safety and Uncertainty Quantification, Institute of Structural Engineering*, ETH Zürich.

- Supervision of PhD students and postdocs
- Improved the overall IT infrastructure of the Chair to handle the much larger UQLab userbase by improving redundancy and security
- Represented the Chair in a several venues, from conferences to summer schools
- Directly supervised the technical and IT organization of different ETH events (e.g. MascotNum 2014, ESREL 2015)

2012–2013 **Postdoctoral researcher**, Chair of Risk, Safety and Uncertainty Quantification, *Institute of Structural Engineering*, ETH Zürich, Switzerland.

- Designed and implemented the core features of the UQLab software as a tool to share and distribute the codes produced by the chair researchers
- Set up and maintained a complete collaborative development infrastructure in view of a long-term effort by chair members and external contributors. This included bug-tracking systems, code versioning and project management tools
- Led the technical development of the first features of the software by managing a group of 3 developers
- Contributed to the development and teaching of the Master course "Uncertainty Quantification in Engineering" (101-0178-01L), including frontal lectures, exercises and tutorials
- Handled applied research collaborations with other ETH Chairs (e.g. VAW)
- Ordered, configured and maintained the initial batch of parallel computing resources of the Chair

2011–2012 **Postdoctoral researcher**, *Institute of Geophysics, Faculty of Geosciences and Environment*, University of Lausanne, Switzerland.
I carried out research on the topic of uncertainty quantification in tomographic imaging. I wrote a scientific proposal as co-PI to the Swiss National Science Foundation (SNSF) for a PhD student (granted).

2011–2012 **Consultant** (*Sub-contractor for AUGers Gmbh*)
Together with fellow Ph.D student N. Tisato I co-designed, assembled, validated and deployed a 32-channel fully automated seismic acquisition system used by NAGRA (Swiss National Cooperative for the Disposal of Radioactive Waste) in the context of a long-term project for the monitoring of radioactive waste disposal technology.
I wrote the complete software (C++/MATLAB), including the low-level system drivers, the automation systems and the user-friendly user interface.

2008–2009 **IT developer (Deputy head of IT)**, **Starmind Gmbh,** Zürich, Switzerland.
Starmind Gmbh (now Starmind AG) was a small start-up that aimed at creating a web-based know-how sharing network with a focus on research institutions, now a full-fledged consulting business.

- Contributed to the initial design and implementation of the web-based platform to allow users to register/post questions/rate answers (*PHP/Javascript*)
- Created the back-end infrastructure to deal with strong multi-language support, from font encoding to consistent multi-tabbed browsing and de-duplication (*e.g.* for credit card transactions) (*PHP/Javascript/Zend framework*)
- As deputy head of IT, I was responsible for the high availability and reliability of the "live" web servers/databases, as well as for the training of new developers

2006–2007 **Process development engineer**, *STMicroelectronics R&D*
Involved in the development of dry etching techniques for microelectronics manufacturing. My responsibilities included process development for upcoming tech (phase change memory and OLEDs) as well as commissioning of new production hardware.

Education

2007–2011 **PhD thesis**, *ETH Zürich*, Switzerland

Specialty:	Geophysics
Title:	Seismic imaging of temporal changes in underground radioactive waste repositories: surveillance requirements and full-waveform inversion issues
Group:	Applied and Environmental Geophysics
Supervisor:	Prof. Dr. Hansruedi MAURER
Defence:	October 27, 2011
Committee:	Prof. Dr. Hansruedi MAURER, *ETH Zürich*, Examiner
	Prof. Dr. Alan GREEN, *ETH Zürich*, Examiner
	Prof. Dr. Stewart GREENHALGH, *ETH Zürich*, Examiner
	Prof. Dr. Guy DRIJKONINGEN, *T.U. Delft*, Examiner
Download:	http://dx.doi.org/10.3929/ethz-a-006852891

2004–2006 **MSc in Physics** (with honours), *Università degli Studi di Milano Bicocca*, Italy

2001–2003 **BSc in Physics** (with honours), *Università degli Studi di Milano Bicocca*, Italy

Personal skills and competences

Languages

Italian	Mother tongue				
Foreign		Listening	Reading	Speaking	Writing
	English	C2	C2	C2	C2
	German	B2	B2	B2	B2
	French	A1	A1	A1	–

Technical skills

Software

Programming languages	Matlab	*expert*
	C/C++	*expert*
	R	*occasional*
	Python	*occasional*
	Java	*occasional*
	Fortran	*beginner*
Distributed computing	Openmp (shared mem.)	*expert*
	MPI (distributed mem.)	*expert*
	MATLAB distributed computing server	*expert*
	Torque/Slurm (scheduler)	*expert/admin*
Web development	HTML	*expert*
	PHP	*expert*
	mySQL (database)	*expert/admin*
	Javascript	*occasional*
	CSS	*occasional*
Collaborative development	Subversion	*expert/admin*
	GIT	*expert/admin*
	Trac	*expert/admin*
	Redmine	*expert/admin*
	SCRUM agile development	*expert*
Other	Bash/tcsh unix scripting	*expert*
	SED/AWK manipulation	*occasional*

System Administration

Operating Systems	Linux	*expert*
	Windows	*expert*
	MacOS	*occasional*
Webservers/ Databases	Apache 2.X	*expert*
	MySQL	*expert*
Cloud	Docker	*occasional*
	Google Cloud	*occasional*

Hardware

Extensive theoretical and functional knowledge of physics, geophysics, microelectronic and IT hardware. Professional experience in hardware design, assembly, commissioning, deployment, profiling, validation and automation.

Scholarships

2004	CERN Summer Students Programme (∼6'000CHF, 3 months scholarship) I produced a report on "Temperature corrections in off-line analysis of the irradiation testbeam for ECAL"

Research topics, supervision, publications (summary)

Research topics

2012- Uncertainty quantification for engineering and applied science:

- Scientific software design, validation, optimization and public distribution (the UQLAB framework, www.uqlab.com,uqpylab.uq-cloud.io)
- Surrogate models (metamodels) for UQ and machine learning: stochasti spectral embedding, polynomial chaos expansions, Kriging, multi-fidelity metamodels
- Applications in engineering and applied sciences: wind turbine design, renewable energy, hybrid simulation, geophysics, dam breach modeling, remote sensing, computational macroeconomics, astrophysical simulations, etc.
- Active learning methods for reliability analysis and uncertainty quantification
- UQ for high dimensional problems (input/output)
- Probabilistic modeling of complex data (Bayesian inference, copula theory, etc.)
- Bayesian inversion (model calibration, tomographic imaging)

2011-2012 MCMC-based Bayesian inversion applied to hydrogeophysical problems. Focus on anisotropy in fractured rock, geophysical imaging, MAP & stochastic inversion.

2007–2011 Bayesian seismic tomography for the non-intrusive monitoring of radioactive waste repositories. Full-waveform inversion, experimental design, acquisition, digitization and modeling of experimental data, digital signal processing.

Research supervision

- 8 M.Sc. theses, 3 of which received ETH awards
- 2 completed + 4 ongoing Ph.D theses
- Several academic guests (including PhD students and postdocs)
- Multiple collaborations with research groups within and outside ETH

Publications

- 1 book chapter
- 1 edited book
- 42 articles in peer-reviewed international journals (leading co-author in the papers related to the collaborations I supervise)
- 58 papers and talks in international conferences
- 20 technical reports

Citation metrics

As of February 2022, my impact factors as computed by Google Scholar (excluding publications with the *CMS collaboration*) are **h = 22** and **i10 = 40** based on a total of over 2400 citations

2 Teaching activities

Master Courses

Structural Reliability and Risk Analysis

Since Fall Semester 2017, I am responsible of and teach the course *Structural reliability and Risk analysis* (ref.: 101-0187-00L). Structural reliability aims at quantifying the probability of failure of systems due to uncertainties in their design, manufacturing and environmental conditions. Risk analysis combines this information with the consequences of failure in view of optimal decision making. The course presents the underlying probabilistic modeling and computational methods for reliability and risk assessment.

Uncertainty Quantification in Engineering

(co-lecturer with Prof. B. Sudret, 50%)

I am co-teaching with Prof. B. Sudret for the course *Uncertainty quantification in engineering* (Ref: 101-0178-01L) since spring 2014. Uncertainty quantification aims at studying the impact of aleatory- (e.g. natural variability) or epistemic uncertainty onto computational models used in applied sciences and engineering. The course introduces the basic concepts of uncertainty quantification: probabilistic modeling of data (using copula theory), uncertainty propagation techniques (Monte Carlo simulation, polynomial chaos expansions) and sensitivity analysis (Sobol' indices).
I teach the numerical lab classes, exercises, as well as substitute Prof. Sudret in frontal lectures whenever needed, e.g. throughout 2020 during his sabbatical leave.

PhD Courses

PhD course on Uncertainty Quantification & Data Analysis in Applied Sciences

(co-lecturer with Prof. B. Sudret, 70%)

The course presents fundamental concepts and advanced methodologies for handling and interpreting data in relation with models. It elaborates on methods and tools for identifying, quantifying and propagating uncertainty through models of systems with applications in various fields of engineering and applied sciences. Part of the Computational Science Zurich Graduate School (20 hours).

Continuing education

Certificate of advanced studies on Natural Hazards - Risk Management (ETH)

(co-lecturer with Prof. B. Sudret, 50%)

The course focuses on fundamental concepts and practices in natural hazards risk assessment and management.
We provide an introduction to quantitative risk assessment methods (probabilistic UQ and reliability analysis), followed by a 3-hour hands on tutorial/workshop tailored to the students' specific backgrounds (total: 7 hours).

Master of advanced studies on Fire Safety Engineering (ETH)

(co-lecturer with Prof. B. Sudret, 50%)

This Master of advanced studies in ETH aims at providing participant with state of the art tools to identify, assess and safely manage risks associated with fire in civil engineering.
We teach the probability & statistics, as well as quantitative tools for uncertainty quantification (32 hours). The course also includes a full 1-day workshop with interactive tutorials based on our UQLab software.

Past Activities

I was involved in the IDEA League Joint Master's in applied geophysics in 2009–2010. The Joint Master's in Applied Geophysics is a two-year joint degree programme offered by three of Europe's leading science and technology institutions: Delft University of Technology, ETH Zurich and RWTH Aachen University. The programme offers a combination of study and research, leading to an outstanding qualification in Applied Geophysics relevant for careers in the areas of Earth resource exploration and management (hydrocarbon, geothermal) and environmental and engineering investigations.
I was involved in frontal teaching (seismic refraction tomography), field data collection, supervision of the students' reporting and co-supervision of a master's thesis.

3 Research activities

UQLab and & UQCloud

Since its initial conception in early 2013, I have been leading the development of the UQLAB framework together with Prof. Sudret. UQLAB is a state-of-the art general-purpose software for uncertainty quantification. It is intended as a common platform to consistently share algorithms and codes produced during the Chair research activities both internally (by making the newest results immediately available the group members, and for teaching purposes), as well as internationally through a public release life-cycle (www.uqlab.com).

Since the launch of the first public beta version on July 1st, 2015, and the open source public version 1.0 on May 1st, 2017, the number of registered users has been increasing constantly, as of January 2022 counting over 4200 users from 94 countries worldwide, making UQLAB a standard tool in the UQ software scene in just a few years. The reference conference paper on the software (**Marelli** and Sudret, 2014a) has now been cited in over 520 scientific works (source: Google scholar, see also www.uqlab.com/publications).

I also supervise the design and development of the next phase of the UQLAB project, in which state-of-the-art cloud-computing techniques are used to provide worldwide users with a language- and platform-independent, cloud-based UQ software solution (`https://uqpylab.uq-cloud.io/`, Lataniotis et al. 2021).

I am responsible for the strategic planning of upcoming features and release milestones as well as the technical lead of the development team, consisting of 3-7 chair members at any given time. I am also responsible for the design, deployment and maintenance of a dedicated server infrastructure that provides its agile development environment, from versioning to ticketing, to software packaging and web hosting.

Related publications: **Marelli** and Sudret, 2014a,b, 2016a,b, 2017a, Lataniotis et al., 2018, 2021

Chair Research

Uncertainty quantification for grey-box modeling (GREYDIENT)

With the rapid rise of modern, machine-learning-powered design paradigms like grey-box modeling and digital twins, handling the uncertainty related to mixing real data (e.g from experiments) and numerical models is becoming paramount.

As PI of the GREYDIENT Marie-Curie ITN from the EU, I lead a small research subgroup of two PhD students/ESRs (K. Giannokou and A.V. Pires), to investigate and introduce a quantitative framework for uncertainty quantification of grey-box and noise-contaminated models. I am also responsible for the organization of network training events, courses, workshops, etc.

Surrogate modeling for aero-servo-elastic simulations (HIPERWIND)

The design and assessment of real scale wind turbines and farms is a highly computationally challenging problem. Due to the intrinsic variability of wind and environmental conditions, assessing the long-term performance and reliability of a wind turbine can require thousands, sometime even hundreds of

thousands, of expensive aero-servo-elastic simulations. Costs for similar analysis at the wind farm scale are even more challenging.
I design and develop advanced surrogate modeling techniques that can entirely substitute the expensive aero-servo-elastic simulators, at massively reduced costs. I am the ETH project manager and task-leader of the HIPERWIND project, and I supervise a PhD student (S. Schaer) within this project. I am also directly involved in the research of several WP (e.g. expected fatigue assessment, ULS reliability estimation, etc.).

Surrogate modeling and machine-learning (2018–ongoing)

Surrogate modeling is central to uncertainty quantification. Over the recent years, the boundaries between surrogate modeling and machine learning (ML) have consistently thinned, with extensive cross-breeding between the two disciplines.
I have been actively researching on different ways to optimize existing surrogate modeling techniques, as well as mixing them with concepts from the ML literature to develop surrogates that scale well both with the input dimension and with the size of the available training set.
Related publications: Wagner et al., 2021b, **Marelli** et al., 2021a, Wagner et al., 2021a, 2019a, Lüthen et al., 2021

Uncertainty quantification in high dimensional problems (2015–2020)

An important problem in many real-case uncertainty quantification problems is how to deal with models with very high dimensional inputs and outputs. I have been actively researching innovative methods to quantitatively tackle this problem by combining advanced UQ and machine learning techniques. The final goal of this research is to enable researchers to efficiently perform UQ (uncertainty propagation, sensitivity and structural reliability analysis, reliability-based design optimization) for complex engineering models (*e.g.* detailed FEM models of existing or planned structures) with a very large number of degrees of freedom ($\mathcal{O}(10^{5-6})$).
I carry out research on this topic both independently and in the context of the PhD. project of C. Lataniotis.
Related publications: **Marelli** and Sudret, 2015a, Lataniotis et al., 2016, 2017a,b, 2020, Hosseini et al., 2020

Active learning methods for structural reliability analysis (2016–ongoing)

Adaptive design of experiments based on active learning and surrogate models is a highly active research field worldwide. I have been involved in the design of new active-learning techniques in the context of structural reliability analysis since 2015, when I collaborated with Dr. Schöbi (a PhD student of the Chair at the time) to the development of a novel algorithm based on a metamodeling technique recently introduced by the Chair (PC-Kriging).
I also extended the well-established polynomial chaos expansion metamodeling technique to make it suitable for active-learning in an innovative framework based on bootstrapping.
Related publications: Schöbi et al., 2016, **Marelli** and Sudret, 2016c, 2017b, 2018a, Wagner et al., 2021b

Optimal design of experiment for surrogate modeling (2015–2017)

During Dr. Fajraoui stay at the Chair as a postdoc in 2015–2017, I have been closely collaborating with her on the topic of optimal design of experiment for surrogate modeling. Surrogate models, and polynomial chaos expansions in particular, are a fundamental tool in modern UQ applications in the presence of expensive computational models. I have co-supervised Dr. Fajraoui from the early stages of her research on how to optimize the available computational budget to obtain accurate surrogates in realistic engineering scenarios. I have been involved both in the development of technical solutions at various stages of the research, as well as structuring, partially writing and revising the resulting paper.
Related publications: Fajraoui et al., 2017a,b

Collaborations within the ETH Civil Engineering Dept. (D-BAUG)

Surrogate-aided reliability and resilience for timber structures (2020–)

Collaboration with the Chair of Prof. Dr. Frangi, IBK (D-BAUG)

Within the scope of the PhD projects of Mr. Schilling, Wydler and Voulpiotis at the Chair of Timber Structures led by Prof. Frangi, I provide support on the probabilistic- and machine-learning- aspects of both reliability analysis and resilience modeling/analysis.
The use of UQLab, as well as the attendance of the three students to several of my courses, allows this collaboration to focus on the more pressing scientific issues, which include the probabilistic modeling of expert knowledge, and the setup and parsimonious solution of complex multi-scale structural reliability problems associated to innovative timber structures.

Surrogate and multi-fidelity modeling for hybrid simulation (2016–2019)

Collaboration with the Chairs of Prof. Dr. Stojadinovic, and Prof. Dr. Chatzi, IBK (D-BAUG)

During his postdoctoral research in the group of Prof. Stojadinovic, Dr. Abbiati initiated a collaboration with me aimed at including uncertainty quantification in hybrid simulation for seismic design. I have been since directly involved in setting up such analysis, initially focusing on devising efficient surrogate modeling techniques based on limited experimental data, as well as active learning strategies that could be applied in the context of non-destructive hybrid testing.
As of today, the collaboration veered on the topic of multi-fidelity surrogate modeling for hybrid systems. This is an extension of the collaboration with Dr. Abdallah, a former postdoc in the Chair of Risk and Safety, now postdoctoral researcher in the Chair of Prof. Chatzi. I am directly responsible for the UQ and surrogate modeling-related aspects central to the research.
Related publications: Abbiati et al., 2015a,b,c, 2017a,b, 2020, 2021

Uncertainty Quantification in Dam Breach modeling (2013–2018)

Collaboration with the Chair of Prof. Dr. Boes, VAW (D-BAUG)

My collaboration with the group of Prof. Boes started in 2013, when I co-supervised several semester projects aimed at introducing advanced uncertainty quantification tools in the field of dam breach modeling. I personally supervised the semester projects at all stages on the topic of UQ, central to their projects, in close collaboration with Dr. Samuel Peter, a recent PhD graduate at VAW. Based

on their preliminary results, I supervised the MSc thesis of A. Eicher, who was awarded the Heinrich Hatt-Bucher Preis in 2014.
I continued to represent the Chair of Risk, Safety and Uncertainty Quantification throughout the collaboration until the graduation of Dr. Peter in July 2017.
Related publications: Peter et al., 2018

Metamodel-based inversion for rice crop monitoring (2015–2017)

Collaboration with the Chair of Prof. Dr. Hajnsek, IFU (D-BAUG)

Monitoring of large scale rice crop fields based on satellite imaging is a highly active research field in the remote sensing community, due to its potentially high societal impact. After an initial kick-off meeting between Prof. Hajnsek (IFU) and Prof. Sudret, I became the contact point between the two Chairs in D-BAUG in a project devoted to the inclusion of UQ (metamodeling and sensitivity analysis) in the field of remote sensing. My role in the collaboration was to directly supervise Dr. Yüzügüllü (as part of his PhD project) in properly stating the problem in terms of uncertainty quantification, as well as to devise and deploy the relevant methods to solve it efficiently (surrogate modeling, design of experiments and sensitivity analysis). I also wrote the sections on methodology as well as the statistical interpretation of the analysis results in the final journal paper.
Related publications: Yüzügüllü et al., 2015, 2017

Other Collaborations

Metamodel-based fast simulation for additive manufacturing (2019–ongoing)

Collaboration with Dr. E. Hosseini, EMPA (Switzerland)

While additive manufacturing solutions are available industrially, virtual prototyping remains still a marginal topic, due to the high computational costs involved. In this project, bootstrapped in 2019 with the joint supervision of Mr. F. Keller at EMPA, we employ state-of-the art dimensionality reduction methods and surrogate models to significantly reduce the associated costs, thus making numerical modeling attractive in this field. Among the challenges of this project, is that both model intpus and model outputs are high dimensional maps ($\mathcal{O}(10^3)$).
Co-supervision of a second MSc student will start in HS2020.
Related publications: Hosseini et al., 2020, MSc thesis of Mr F. Keller

Uncertainty quantification and sensitivity analysis in renewable energy policy design (2020–ongoing)

Collaboration with Dr. T. Tröndle and Prof. J. Lillesham, Potsdam University, and with Prof. S. Pfenninger, ETH Zürich

To ensure a feasible transition to a fully renewable electricity in Europe is a gargantuan endeavour that requires large investments in infrastructure, be it for energy production or storage. Within this project, I take advantage of state-of-the-art tools from uncertainty quantification, such as multi-fidelity polynomial chaos expansions and variance decomposition techniques, to perform analyses otherwise computationally impossible to address.

Thanks to such tools, the researchers ad Potsdam and ETH were able to quantify the impact of continent vs. nation- vs. region- mandated policies on the cost of electricity in the mid-term future. The overall results show that even in the worst case scenario (i.e. a fully regional policies with little inter-regional coordination), a full-renewable transition is still feasible, at an acceptably ($\sim 20\%$) higher cost.
This study has resulted in a joint journal paper in the prestigious journal *Joule* (impact factor of 15).
Related publications: Tröndle et al., 2020

UQ and machine learning for hybrid simulation (2019–ongoing)

Collaboration with Prof. Dr. G. Abbiati, Aarhus University (Denmark)

Hybrid simulation combines physical and numerical substructures interacting with each other in a real-time control loop to simulate the time history response of a prototype structure subjected to a realistic excitation.
Within this project, we develop novel methods to drive experimental campaigns that maximize the expected information content from each measurement, hence minimizing the associated costs. The use of active learning methods coupled with the latest surrogate modeling techniques allows for unprecedented accuracy at manageable computational costs.
Related publications: Tsokanas et al., 2021, Abbiati et al., 2021, 2020, 2018a,b

The EuclidEmulator and planetary collisions (2015–2021)

Collaboration with the group of Prof. Dr. R. Teyssier, Professor of Computational Astrophysics, University of Zürich

In this partnership with the University of Zurich and the Euclid consortium we developed a novel power spectrum emulator that can significantly accelerate cosmological investigations into the origin of the observable accelerating universe.
The so-called EUCLID emulator can accurately estimate the non-linear component of the dark matter power spectrum as a function of the six cosmological parameters ω_b, ω_m, n_s, h, w_0 and σ_8. Constructed within the UQLab software framework, it combines sparse polynomial chaos expansions and principal component analysis to deal with the non-linear, high dimensional response of the simulations. All steps in its construction have been tested and optimized: the large high-resolution N-body simulations carried out with PKDGRAV3 were validated using a simulation from the Euclid Flagship campaign. The emulator is based on 100 input cosmologies simulated in boxes of $(1250Mpc/h)^3$ using 2048^3 particles. The absolute accuracy of the final nonlinear power spectrum is approximately as good as that obtained with N-body simulations, or $\sim 1\%$. Such accuracy, coupled with the computational efficiency of the emulator, enables highly efficient forward modeling in the nonlinear regime, one more step towards the ambitious goal of identifying the cosmological parameters that generated the observable universe.
Thanks to the success of the EuclidEmulator,similar tools were successfully applied and benchmarked favorably to state-of-the-art machine learning techniques to emulate expensive planetary collision simulations.
Related publications: Knabenhans et al., 2021, Timpe et al., 2020, Knabenhans et al., 2019

High dimensional copula modeling for uncertainty quantification (2016–2019)

Risk-Center project with the Chair of Prof. Dr. Embrechts (RiskLab, ETH Zürich)

Properly accounting for the statistical dependence between input parameters of a computational model can be of paramount importance when estimating its stochastic behaviour. As an example, tail dependence on the system loads (*i.e.* the increased correlation between the loads during extreme events) can dramatically change the reliability and resilience of a system, hence playing a major role in risk assessment and mitigation. This research aims at developing a quantitative and flexible framework for the modeling and inference of complex dependence structure from available data and expert knowledge. This project is funded through the ETH Risk Center. I have been prominently involved in the project by writing the methodological section of the joint proposal that was funded in 2016, as well as directly supervising Dr. Torre, the postdoctoral researcher who developed and validated the approach throughout 2017.

Related publications: Torre et al., 2017a,b,c, 2019a,b

Uncertainty quantification for hydropower risk assessment (2015–2019)

Collaboration with the group of Dr. Burgherr, Technology assessment group, LEA laboratory (Paul Scherrer Institute, Villigen)

This collaboration started as the joint supervision of the first year of the PhD of Ms. Kalinina with the group of Dr. Burgherr in PSI. The contact came from my pre-existent network built during my PhD in Geophysics at ETH Zürich. The topic of the project is the introduction of uncertainty quantification techniques in the risk assessment of hydropower dams in Switzerland. Under the direct supervision of Prof. Sudret and myself, in her first year Ms. Kalinina developed a framework to incorporate uncertainties inherent to the failure of large concrete dams due to overtopping, which is then propagated to the downstream populated areas to assess and reduce the uncertainty in the resulting risk assessment. I was involved in the week-to-week direct supervision of her PhD, including setting short and long term goals, technical and methodological support and reporting.

Related publications: Kalinina et al., 2016a,b, 2020

Efficient metamodeling of frequency response functions (2016–2018)

Collaboration with the Chair of Prof. Dr. Abrahamsson, Chalmers University (Sweden)

Dr. Yaghoubi joined the Chair of Prof. Sudret as a guest PhD student for a 6-months stay in ETH in 2016. During this highly productive period, he incorporated the latest developments of the Chair into the challenging field of structural dynamics under my supervision, developing effective solutions to overcome well-known limitations of the use of metamodels. My supervision included the technical aspects of the research on frequency response functions, the related reporting, the interpretation of the results and the final paper write-up.

Given the success of our collaboration, Dr. Yaghoubi (now a postdoctoral researcher at the Isfahan University of Technology in Iran) and I extended the original results in a follow-up project on mode dominance analysis. I participated to the interpretation of the results, as well as to the writing of the resulting journal paper.

Related publications: Yaghoubi et al., 2016, 2017, 2018

Sensitivity and reliability analysis in cyber-physical systems (2018–2019)

Collaboration with the Chair of Prof. Dr. Sorensen, Centre for Autonomous Marine Operations and Systems, NTNU (Norway)

After the completion of the course Uncertainty Quantification and Data Analysis in Applied Sciences in March 2017, I was contacted by one of the students (Mr. Sauder, a PhD student at NTNU Norway), to provide guidance for the application of some of the advanced methods presented in the block course in the context of cyber-physical control systems for marine operations. I developed a customized version of the UQLab software to suit their specific computational needs and I also contributed to the interpretation of the results, as well as to writing the methodological and results sections of the final papers, one of which has been published in the prestigious journal Automatica.

Related publications: Sauder et al., 2018, 2019

Global sensitivity analysis in computational macroeconomics (2015–2019)

Risk Center projects with the Chair of Prof. Dr. Bommier, MTEC, (ETH Zürich)

Sensitivity analysis is an important field in computational macroeconomics, because it can be used to assist decision makers to devise appropriate economical decisions at the local/national/international scale. Classical tools found in the recent macroeconomic literature are still mostly local and based on one-at-a-time finite difference scenario modeling. This research demonstrated that such type of analysis is unsuitable in the presence of the complex, highly non-linear models typical in the macroeconomics literature, and introduces appropriate quantitative tools from UQ (global sensitivity analysis and surrogate models) to provide accurate results within an affordable computational budget.

Throughout the postdoctoral research of Dr. Winschel, I have provided guidance in casting the problem in a more general UQ framework, and I adapted the software tools needed to perform the analysis. I also had major involvement in the validation and interpretation of the final results, including running the analysis and writing-up the results and their interpretation for the final journal paper.

This work has been featured as the leading article of the first issue of Quantitative Economics in January 2019.

Related publications: Harenberg et al., 2019

Supervision of Ph.D students

Katerina Giannokou

Multi-fidelity surrogate modeling of grey box models

2021– (funded by the GREYDIENT project)

Anderson Vinha-Pires

Structural reliability analysis for noise-contaminated grey-box models

2021– (funded by the GREYDIENT project)

Styfen Schär

Advanced metamodeling techniques for the design and assessment of offshore wind turbines

2021– (funded by the HIPERWIND project)

Tong Zhou (1-year, 2021-2022)

Active learning applied to PDEM for reliability analysis of complex engineering systems

2021–2022 (funded by the Chinese NSF)

Nora Lüthen (co-supervision)

Sparse polynomial chaos expansions for stochastic emulators

2017– (funded by the SAMOS project)

Paul-Remo Wagner (co-supervision)

Advancements in sample-free approaches to Bayesian inversion

2017–2021 (Defended: September 3, 2021)

https://www.research-collection.ethz.ch/handle/20.500.11850/513631

Anna KALININA (1 year, 2015–2016)

Uncertainty quantification in the risk analysis of large dam failure

2015–2016 (Defended: 2019)

Christos LATANIOTIS

Data-driven Uncertainty Quantification for High-Dimensional Engineering Problems

2015–2019 (Defended: Nov 8, 2019)

https://www.research-collection.ethz.ch/handle/20.500.11850/377865

Fritz SIHOMBING (1-year excellence scholarship ETH-South Korea)

Uncertainty quantification for efficient earthquake early-warning systems

2017–2018

Supervision of master's theses

2021 **Pietro Maria Francesco PARISI**, ETH Zürich, master's thesis
Active learning for system rare event estimation

2020 **Riccardo ARRIGONI**, ETH Zürich, master's thesis
Uncertainty propagation and sensitivity analysis in hydrology

2019 **Fabian KELLER**, EMPA - ETH Zürich, master's thesis
Surrogate modeling for multiscale thermal simulation of power-bed additive manufacturing

2018 **Florian SCHMID**, ETH Zürich, master's thesis
A new moment-independent measure for reliability-sensitivity analysis
Awards: Heinrich Hatt-Bucher Preis (3rd prize)

2017 **Philippe WIEDERKEHR**, ETH Zürich, master's thesis
Sensitivity analysis in the presence of input dependence

2016 **Matteo BERCHIER**, ETH Zürich, master's thesis
Multi-fidelity surrogate modeling with polynomial chaos expansions
Awards: Heinrich Hatt-Bucher Preis (2nd prize), ETH Medal

2014 **Alessandra EICHER**, ETH Zürich, master's thesis
Bayesian multilevel model calibration of a simplified dam breach model
Award: Heinrich Hatt-Bucher Preis (1st prize)

2011 **Ludwig AUER**, ETH Zürich, master's thesis
A critical appraisal of asymptotic 3D-to-2D data transformation and the potential of complex frequency 2.5-D modeling in seismic full waveform inversion

Research funding

2020

Marie Curie call: H2020-MSCA-IF-2020

Physics-informed Spectral Expansions for Uncertainty Quantification (PISEUQ)

co-P.I.

Status: **Not Funded** (∼220kCHF requested, 1 Postdoc)

As a co-PI, I will directly be involved in the supervision of the Marie-Curie postdoc on the development and validation of physics-informed spectral expansion methods for UQ.

FET Open 2020 June call

New AveNues for the Optimal DesIgn of Mechanical Metamaterials (NANODIMM)

P.I for ETH Zürich

Status: **Not Funded** (∼600kCHF requested, 1PhD Student + self-funding)

I am PI for ETH, leading a work-package dedicated to the development of smart model- and data- fusion strategies, and AI-based design of experiment for a novel metamaterial modeling paradigm. Reliability-based design optimization and uncertainty quantification in of novel metamaterials still remain central to the project.

H2020, Call: H2020-LC-SC3-2020-RES-RIA

HIghly advanced Probabilistic design and Enhanced Reliability methods for high-value, cost-efficient offshore WIND (HIPERWIND)

co-P.I for ETH Zürich (P.I.: Prof. B. Sudret)

Status: **Funded** (∼600kCHF, 1PhD Student + partial self-funding)

HIPERWIND aims at introducing recent advances in probabilistic methods for reliability-based design optimization into the wind turbine design industrial practice.

As co-PI with Prof. Sudret, my involvement include both the co-supervision of a PhD student (S. Schär), as well as the technical IT and IP support needed to connect the methodological advancements to the industrial practice through software.

H2020, Call: H2020-MSCA-ITN-2020 Innovative Training Networks (ITN)

European Training Network on Grey-Box Models for Safe and Reliable Intelligent Mobility Systems (GREYDIENT)

P.I for ETH Zürich

Status: **Funded** (∼600kCHF, 2 PhD students)

The main goal of the GREYDIENT Innovative Training Network is preparing a new generation of young researchers and professionals that are exposed to the state of the art in both classical computational modeling (white box modeling) and data-driven methods (black-box modeling).

As PI for ETH, am the project manager and directly supervise the two ESRs (K. Giannoukou and A. V.-Pires). I am also actively involved in the steering of the network (e.g. event organization) and in fostering its development.

2020 **FET Open 2020, January call**

From Discrete Mechanics to a new generation of Metamaterial TECHnology (DMEMTECH)

P.I for ETH Zürich

Status: **Not funded** (∼500kCHF requested, 1PhD Student + self-funding)

FET Open projects are the *high risk-high-reward* siblings of the standard H2020 calls, favoring bold ideas to more conservative, low-risk ones.

In this spirit, this project aims at completely re-writing the rules of computational modeling for the now ubiquitous metamaterials, from the discrete algebra up, including advances in data fusion, grey box modeling and machine learning. I am PI for ETH, leading a work-package dedicated to the development of smart model- and data- fusion strategies in the context of reliability-based design optimization and uncertainty quantification.

2019 **H2020, Call: H2020-MSCA-ITN-2019 Innovative Training Networks (ITN)**

Grey-box Models for Safety and Reliability Assessment (GREYDIENT)

P.I for ETH Zürich

Status: **Not funded** (∼600kCHF requested, 2 PhD students)

I am the P.I. for ETH, one of hte leading partners in this international training network between 10 beneficiary academic institutions from the EU and 13 industrial project partners. I contributed to all the stages of the network proposal, from its scientific contents (based on combining machine learning with physics-based models) to the identification of the network partners, to the design of the network coordination and the dissemination of its results through modern technologies and social media.

H2020, Call: H2020-MG-2018-2019-2020 Mobility for Growth (Phase 1)

Efficient approaches for the design of Real-time adaptive protection systems in future vehicles

P.I for ETH Zürich

Status: **Not funded** (∼350kCHF requested, 1 Senior Researcher)

2018 **H2020, Call: H2020-LC-SC3-2018-2019-2020 Secure, clean and efficient energy**

Robust and Unified Development of Future Floating Wind Parks (ROUND-OFF)

Co-P.I for ETH Zürich

Status: **Not funded** (∼200kCHF requested, 1 PhD student)

H2020, Call: H2020-SC5-2018-2019-2020 Sustainable Development

Implementing Rapid Earthquake Characterization and Advance Warning System Using The Internet of Things (RECOvERy)

P.I for ETH Zürich

Status: **Not funded** (∼200kCHF requested, 1 PhD student)

Denmark Innovation Fund

Probabilistic design of wind turbines and plants (ProbWind)

Co-P.I for ETH Zürich

Status: **Not funded** (∼250kCHF requested, 1 PhD student)

2017 **SNSF Research grant #200021_175524** (2 PhD students, 1 Postdoc)
SurrogAte modeling for stOchastic Simulators (SAMOS)
co-PI
Status: **Funded, ongoing** (Total: ∼600kCHF, managed: ∼400kCHF [1 PhD student & 1 Postdoc]) As the co-PI of the project I have managed the IT component of the project, which partially funded the development of the UQCloud software (see the UQLab & UQCloud section). I also co-supervise one of the two PhD students, N. Lüthen.

H2020, Call: H2020-SC1-2016-2017 Personalized Medicine
IN silico Trials Environment for Abdominal wall Device (INSTEAD)
P.I. for ETH Zürich
Status: **Not funded** (∼500kCHF requested, 2 PhD students)
I am the P.I. for ETH in the multidisciplinary consortium (15 partners) and I independently wrote the section on validation, uncertainty quantification, sensitivity and reliability analysis of the proposal. The proposal scored high in the *Excellence* (4/5) and *Impact* (5/5) sections, hence eligible for funding, but only the top 4 proposal in the highly competitive call were eventually selected.

H2020, Call: 2016-2017 Mobility for Growth (Phase 1)
Protect More Road Users by simulating the Population and Situation Variability using Human Body Models (PROSPER-HBM)
P.I. for ETH Zürich
Status: **Not funded** (∼350kCHF requested, 1PhD students+self-funding)

2016 **Risk center seed project** (1 postdoctoral researcher)
Copulas for big-data analysis in engineering applications
B. Sudret, P. Embrechts and S. Marelli
Status: **Funded & completed** (Total, ∼ 100kCHF, fully managed)

2012 **SNSF Research grant #143758** (1 Ph.D student)
Development of a multi-method hydrogeophysical data acquisition and inversion strategy for the 3D geometrical characterization of fractured sedimentary rock aquifers
Co-P.I.
Status: **Funded & completed** (∼ 300kCHF, did not participate to supervision due to leaving the institute)

4 Collective responsibilities

Organization of scientific events

2018	Organization and technical committee of the "IFIP WG-7.5 International conference on Reliability and Optimization of Structural Systems (IFIP 2018)", ETH Zürich, June 26-29, Switzerland
2015	IT coordinator/support for the "25th European Safety and Reliability Conference (ESREL2015)", ETH Zürich, September 7-10, Switzerland
2014	IT coordinator/support for the "*MascotNum Workshop on Computer Experiments and Meta-models for Uncertainty Quantification*", ETH Zürich, April 23rd-25th, Switzerland

Peer reviewing of scientific articles

Journals

I am a regular reviewer for the following journals (Publons profile: https://publons.com/researcher/1163667/stefano-marelli/)

- Aerospace Science and Technology
- AIAA Journal
- Applied Geochemistry
- Applied Mathematical modeling
- ASCE-ASME Journal of Risk and Uncertainty in Engineering Systems, Part A: Civil Engineering
- Computer Methods in Applied Mechanics and Engineering
- Dependence modeling
- Environmental modeling & Software
- Fire Safety Journal
- Geophysics
- International Journal for Numerical Methods in Engineering
- IEEE Access
- Journal of Applied Geophysics
- Journal of Computational Physics
- Journal of Risk and Uncertainty
- Journal of Engineering Mechanics (ASCE)
- Journal of Sound and Vibration
- Ocean Dynamics
- Probabilistic Engineering Mechanics
- Mechanical Systems and Signal Processing
- Reliability Engineering and System Safety
- SIAM/ASA Journal on Uncertainty Quantification
- SoftwareX
- Structural and Multidisciplinary Optimization
- Structural Safety

5 List of Publications

Journal Papers

1.
2.
3.
4. P-R Wagner, **S. Marelli**, I. Papaioannou, D. Straub, and B. Sudret. Rare event estimation using stochastic spectral embedding. *Structural Safety*, 2021b. submitted, preprint available at https://arxiv.org/abs/2106.05824
5. N. Tsokanas, X. Zhu, G. Abbiati, **S. Marelli**, B. Sudret, and B. Stojadinović. A global sensitivity analysis framework for hybrid simulation with stochastic substructures. *Engineering Structures*, 2021. Submitted, preprint available at https://engrxiv.org/kjnec/
6. M. Moustapha, **S. Marelli**, and B. Sudret. A generalized framework for active learning reliability: survey and benchmark. *Structural Safety*, 2021. Submitted, arXiv preprint available at https://arxiv.org/abs/2106.01713
7. G. Abbiati, **S. Marelli**, C. Ligeikis, R. Christenson, and B. Stojadinovic. Training of a classifier for structural component failure based on hybrid simulation and kriging. *ASCE Journal of Engineering Mechanics*. (Under revision, preprint available at https://engrxiv.org/b9kxa/)
8. N. Lüthen, **S. Marelli**, and B. Sudret. Sparse polynomial chaos expansions: solvers, basis adaptivity and meta-selection. *International Journal for Uncertainty Quantification*, 2021a. (Under revision, preprint available at https://arxiv.org/abs/2009.04800)
9. M. G. R. Faes, M. Daub, **S. Marelli**, E. Patelli, and M. Beer. Engineering analysis with probability boxes: a review on computational methods. *Structural Safety*, 93:102092, 2021
10. M. Knabenhans, J. Stadel, , D. Potter, J. M. Dakin, T. Tram, **S. Marelli**, A. Schneider, and R. Teyssier. Euclid preparation: IX. EuclidEmulator2 – Power spectrum emulation with massive neutrinos and self-consistent dark energy perturbations. *Monthly Notices of the Royal Astrophysical Society*, 505:2840–2869, 2021
11. G. Abbiati, M. Broccardo, I. Abdallah, **S. Marelli**, and F. Paolacci. Seismic Fragility Analysis based on Artificial Ground Motions and Surrogate Modeling of Validated Structural Simulators. *Earthquake Engineering and System Dynamics*, 50:2314–2333, 2021
12. P.-R. Wagner, **S. Marelli**, and B. Sudret. Bayesian model calibration with stochastic spectral embedding. *Journal of Computational Physics*, 436:110141, 2021a
13. N. Lüthen, **S. Marelli**, and B. Sudret. Sparse polynomial chaos expansions: Literature survey and benchmark. *SIAM/ASA Journal of Uncertainty Quantification*, 9:593–649, 2021
14. M. L. Timpe, M. H. Veiga, M. Knabenhans, J. Stadel, and **S. Marelli**. Machine learning applied to simulations of collisions between rotating, differentiated planets. *Computational Astrophysics and Cosmology*, 7, 2020
15. T. Tröndle, J. Lilliestam, **S. Marelli**, and S. Pfenninger. Appropriate technology: The relationship between geographic scale, cost, and technology mix of fully renewable electricity systems in europe. *Joule*, 4:1929–1948, 2020
16. **S. Marelli**, P.-R. Wagner, C. Lataniotis, and B. Sudret. Stochastic Spectral Embedding. *International Journal for Uncertainty Quantification*, 11, 2021a

17. A. Kalinina, M. Spada, D.F. Vetsch, **S. Marelli**, C. Whealton, P. Burgherr, and B. Sudret. Metamodeling for uncertainty quantification of a flood wave model for concrete dam breaks. *Energies*, 13(14):3685, 2020

18. G Abbiati, **S. Marelli**, N. Tsokanas, B. Sudret, and B. Stojadinovic. A Global Sensitivity Analysis Framework for Hybrid Simulation. *Mechanical Systems and Signal Processing*, 146:106997, 2020

19. C. Lataniotis, **S. Marelli**, and B. Sudret. Extending classical surrogate modelling to high dimensional problems through supervised dimensionality reduction: a data-driven approach. *International Journal for Uncertainty Quantification*, 10(1), 2020

20. E. Torre, **S. Marelli**, P. Embrechts, and B. Sudret. Data-driven polynomial chaos expansion for machine learning regression. *Journal of Computational Physics*, 388:601–623, July 2019b

21. E. Torre, **Marelli, S.** , P. Embrechts, and B. Sudret. A general framework for uncertainty quantification under non-Gaussian input dependencies. *Probabilistic Engineering Mechanics*, 55:1–16, July 2019a

22. M. Knabenhans, J. Stadel, **S. Marelli**, D. Potter, R. Teyssier, L. Legrand, A. Schneider, B. Sudret, S. Blot, L. AMD Awan, C. Burigana, C. S. Carvalho, H. Kurki-Suonio, and G Sirri. Euclid preparation: II. The EuclidEmulator – A tool to compute the cosmology dependence of the nonlinear matter power spectrum. *Monthly Notices of the Royal Astrophysical Society*, 484:5509–5529, April 2019

23. T. Sauder, **S. Marelli**, and A. J. Sorensen. Fidelity analysis of cyber-physical empirical methods, using efficient non-intrusive probabilistic techniques. *Automatica*, 101:111–119, March 2019

24. D. Harenberg, **S. Marelli**, B. Sudret, and V. Winschel. Uncertainty quantification and global sensitivity analysis for economic models. *Quantitative Economics*, 10:1–41, January 2019

25. C. Lataniotis, **S. Marelli**, and B. Sudret. The Gaussian process modelling module in UQLab. *Soft Computing in Civil Engineering*, 2(3):91–116, 2018

26. **S. Marelli** and B. Sudret. An active-learning algorithm that combines sparse polynomial chaos expansions and bootstrap for structural reliability analysis. *Structural Safety*, 74:67–74, November 2018a

27. S. J. Peter, A. Siviglia, J. Nagel, **S. Marelli**, R. M. Boes, B. Sudret, and D. Vetsch. Development of probabilistic dam breach model using Bayesian inference. *Water Research Resources*, 54:4376–4400, 2018

28. T. Sauder, **S. Marelli**, K. Larsen, and A.J. Sorensen. Active truncation of slender marine structures: influence of the control system on fidelity. *Applied Ocean Research*, 74:154–169, May 2018

29. V. Yaghoubi, S. Rahrovani, H. Nahvi, and **S. Marelli**. Reduced order surrogate modeling technique for linear dynamic systems. *Mechanical Systems and Signal Processing*, 111:172–193, October 2018

30. N. Fajraoui, **S. Marelli**, and B. Sudret. Sequential design of experiment for sparse polynomial chaos expansions. *SIAM Journal of Uncertainty Quantification*, 5(1):1061–1085, 2017a

31. V. Yaghoubi, **S. Marelli**, B. Sudret, and T. Abrahamsson. Sparse polynomial chaos expansions of frequency response functions using stochastic frequency transformation. *Probabilistic Engineering Mechanics*, 48:39 – 58, 2017

32. O. Yüzügüllü, **S. Marelli**, E. Erten, B. Sudret, and I. Hajnsek. Determining rice growth stage with X-band SAR: A metamodel based inversion. *Remote Sensing*, 9(5), 2017

33. R. Schöbi, B. Sudret, and **S. Marelli**. Rare event estimation using Polynomial-Chaos-Kriging. *ASCE-ASME J. Risk Uncertainty Eng. Syst., Part A: Civ. Eng.*, 2016. D4016002

34. L. Auer, A. M. Nuber, S. A. Greenhalgh, H. Maurer, and **S. Marelli**. A critical appraisal of asymptotic 3D-to-2D data transformation in full-waveform seismic crosshole tomography. *Geophysics*, 78(6):R235–R247, 2013

35. Nicola Tisato and **S. Marelli**. Laboratory measurements of the longitudinal and transverse wave velocities of compacted bentonite as a function of water content, temperature, and confining pressure. *Journal of Geophysical Research: Solid Earth*, 118(7):3380–3393, 2013
36. E. Manukyan, H. Maurer, **S. Marelli**, S. A. Greenhalgh, and A. G. Green. Seismic monitoring of radioactive waste repositories. *Geophysics*, 77(6):EN73–EN83, 2012a
37. **S. Marelli**, H. Maurer, and E. Manukyan. Validity of the acoustic approximation in full-waveform seismic crosshole tomography. *Geophysics*, 77(3):R129–R139, 2012
38. E. Manukyan, S. Latzel, H. Maurer, **S. Marelli**, and S. Greenhalgh. Exploitation of data-information content in elastic-waveform inversions. *Geophysics*, 77:R105, 2012b
39. H. Maurer, S. A. Greenhalgh, E. Manukyan, **S. Marelli**, and A. G. Green. Receiver-coupling effects in seismic waveform inversions. *Geophysics*, 77(1):R57–R63, 2012
40. T. Spillmann, P. Blumling, E. Manukyan, **S. Marelli**, H. Maurer, S. A. Greenhalgh, and A. Green. Geophysics applied to nuclear waste disposal investigations in Switzerland. *First Break*, 28(8):39–50, 2010
41. **S. Marelli**, E. Manukyan, H. Maurer, S. A. Greenhalgh, and A. G. Green. Appraisal of waveform repeatability for crosshole and hole-to-tunnel seismic monitoring of radioactive waste repositories. *Geophysics*, 75(5):Q21, 2010a
42. CMS Collaboration. CMS Physics: Technical Design Report Volume 2: Physics Performance. *J. Phys. G*, 34(CERN-LHCC-2006-021. CMS-TDR-8-2):995–1579. 669 p, 2007. URL http://cds.cern.ch/record/942733

Book Chapters

1. L. Le Gratiet, **S. Marelli**, and B. Sudret. Metamodel-Based Sensitivity Analysis: Polynomial Chaos Expansions and Gaussian Processes. In *Handbook of Uncertainty Quantification*. Springer International Publishing, 2017

Edited Books

1. B. Sudret and **S. Marelli**. Reliability and Optimization of Structural Systems: Proceedings of the 19th IFIP WG-7.5 conference on Reliability and Optimization of Structural Systems, ETH Zurich, Zurich, Switzerland, June 26-29, 2018. In *19th IFIP WG-7.5 Conference on Reliability and Optimization of Structural Systems (IFIP 2018)*. ETH Zurich, Institute of Structural Engineering (IBK), 2019

International conference papers and talks

1. C. Lataniotis, **S. Marelli**, and B. Sudret. Uncertainty quantification in the cloud with UQCLoud. In *Proceedings of the 4th International Conference on Uncertainty Quantification in Computational Sciences and Engineering (UNCECOMP 2021), 28-30 June 2021, Athens, Greece*, 2021
2. N. Lüthen, **S. Marelli**, and B. Sudret. Surrogating stochastic simulators using karhunen-loéve expansion, sparse pce and advanced statistical modelilng. In *4th International Conference on Uncertainty Quantification in Computational Sciences and Engineering (UNCECOMP 2021), 28-30 June 2021, Athens, Greece*, 2021b. (Talk only)

3. P.-R. Wagner, **S. Marelli**, I. Papaioannou, D. Straub, and B. Sudret. An active learning reliability algorithm based on local spectral residual expansions of the limit state function. In *4th International Conference on Uncertainty Quantification in Computational Sciences and Engineering (UNCECOMP 2021), 28-30 June 2021, Athens, Greece*, 2021c. (Talk only)
4. P. M. F. Parisi, C. Lataniotis, **S. Marelli**, and B. Sudret. Combining surrogate models by ensemble learning techniques for uq. In *4th International Conference on Uncertainty Quantification in Computational Sciences and Engineering (UNCECOMP 2021), 28-30 June 2021, Athens, Greece*, 2021. (Talk only)
5.
6. **S. Marelli**, X. Zhu, and B. Sudret. Data-driven probabilistic modeling through generalized lambda distributions and vine copulas. In *14th World Congress on Computational Mechanics (WCCM) and 8th European Congress on Computational Methods in Applied Sciences and Engineering (ECCOMAS) (virtual), Paris, France, January 11-15, 2021*, 2021b
7. N. Luethen, **S. Marelli**, J. Wiart, and B. Sudret. Surrogating stochastic emulators with sparse pce. In *14th World Congress on Computational Mechanics (WCCM) and 8th European Congress on Computational Methods in Applied Sciences and Engineering (ECCOMAS) (virtual), Paris, France, January 11-15, 2021*, 2021
8. P.-R. Wagner, **S. Marelli**, and B. Sudret. Stochastic spectral likelihood embedding for the calibration of heat transfer models. In *14th World Congress on Computational Mechanics (WCCM) and 8th European Congress on Computational Methods in Applied Sciences and Engineering (ECCOMAS) (virtual), Paris, France, January 11-15, 2021*, 2021d
9. Ehsan Hosseini, P. Gh. Ghanbari, F. Keller, **S. Marelli**, and Edoardo Mazza. Deploying artificial intelligence for component-scale multi-physical field simulation of metal additive manufacturing. In Mirko Meboldt and Christoph Klahn, editors, *Industrializing Additive Manufacturing*, pages 268–276, Cham, 2020. Springer International Publishing
10. Giuseppe Abbiati and **S. Marelli**. Sequential experimental design of hybrid simulations for bayesian calibration of computational simulators. In *In17th World Conference on Earthquake Engineering (17WCEE)*, 2020
11. E. Torre, **S. Marelli**, and B. Sudret. Representation of complex dependencies with copulas in UQLab. In *Proc. 3rd Int. Conf. Uncertainty Quantification in Computational Sciences and Engineering (UNCECOMP), Crete Island (Greece), June 24-26*, 2019c. (Talk only)
12. P-R. Wagner, C. Lataniotis, **S. Marelli**, and B. Sudret. An adaptive algorithm based on spectral likelihood expansion for efficient Bayesian calibration. In *Proc. 3rd Int. Conf. Uncertainty Quantification in Computational Sciences and Engineering (UNCECOMP), Crete Island (Greece), June 24-26*, 2019b. (Talk only)
13. C. Lataniotis, **S. Marelli**, and B. Sudret. Combining Machine Learning and surrogate modelling for data-driven uncertainty quantification in high-dimension. In *Proc. 3rd Int. Conf. Uncertainty Quantification in Computational Sciences and Engineering (UNCECOMP), Crete Island (Greece), June 24-26*, 2019a. (Talk only)
14. F. Schmid, **S. Marelli**, and B. Sudret. A new reliability-sensitivity measure. In *Proc. 3rd Int. Conf. Uncertainty Quantification in Computational Sciences and Engineering (UNCECOMP), Crete Island (Greece), June 24-26*, 2019. (Talk only)
15. **S. Marelli**, D. Wicaksono, and B. Sudret. The UQLab project: steps toward a global uncertainty quantification community. In *Proc. 13th Int. Conf. on Applications of Statistics and Probability in Civil Engineering(ICASP13), Seoul, South Korea, May 26-30, 2019*, 2019a. (Talk given by B. Sudret)

16. P. Wagner, **S. Marelli**, and B. Sudret. Sequential piecewise PCE approximation of likelihood functions in Bayesian inference. In *Proc. 13th Int. Conf. on Applications of Statistics and Probability in Civil Engineering(ICASP13), Seoul, South Korea, May 26-30, 2019*, 2019a
17. **S. Marelli** and B. Sudret. Surrogate models and active learning for structural reliability analysis. In *JCSS Workshop on Methods for Structural Reliability Analysis - TU Delft*, 2019a. (Talk only)
18. E. Torre, **S. Marelli**, P. Embrechts, and B. Sudret. Data-driven regression and uncertainty quantification by polynomial chaos expansions and vine copulas. In *23rd International Conference on Computational Statistics (COMPSTAT 2018), August 28-31, 2018, Iasi, Romania*, 2018. (Talk only)
19. G. Abbiati, M. Broccardo, **S. Marelli**, B. Sudret, and B. Stojadinovic. A novel seismic structural testing protocol based on hybrid simulation, kriging and active learning: methodology and numerical examples. In *Proceedings of the 19th IFIP WG 7.5 Working Conference on Reliability and Optimization of Structural Systems*, 2018a
20. G. Abbiati, M. Broccardo, **S. Marelli**, B. Sudret, and B. Stojadinovic. A novel seismic structural testing protocol based on hybrid simulation, kriging and active learning: methodology and numerical examples. In *Proceedings of the 19th IFIP WG 7.5 Working Conference on Reliability and Optimization of Structural Systems*, 2018a
21. M. Broccardo, Z. Wang, **S. Marelli**, J. Song, and B. Sudret. Hamiltonian monte carlo-based subset simulation using gaussian process modelling. In *Proceedings of the 19th IFIP WG 7.5 Working Conference on Reliability and Optimization of Structural Systems*, 2018
22. S. Dürr, **S. Marelli**, V. Brookes, M.P. Ward, and B. Vidondo. Benefits and challenges of sobol global sensitivity analysis for epidemiological simulation models - the example of a rabies model in northern australia. In *EPIDEMICS^6 - Sixth International Conference on Infections Disease Dynamics, Sitges, Spain, November 29, December 1, 2017*, 2017. (Poster only)
23. G. Abbiati, I. Abdallah, **S. Marelli**, B. Sudret, and B. Stojadinovic. Hierarchical kriging surrogate of the seismic response of a steel piping network based on multi-fidelity hybrid and computational simulators. In *Proceedings of the 7th International Conference on Advances in Experimental Structural Engineering (7AESE), Pavia, Italy, September 6-8 2017*, 2017b
24. E. Torre, **S. Marelli**, P. Embrechts, and B. Sudret. Modeling high-dimensional inputs with copulas for uncertainty quantification problems. In *Frontiers of Uncertainty Quantification in Engineering (FrontUQ), 6-8 September 2017, Munich, Germany*, 2017c. (Talk only)
25. **S. Marelli** and B. Sudret. Adaptive designs and sparse polynomial chaos expansions for structural reliability analysis. In *Proc. 12th Int. Conf. Struct. Safety and Reliability (ICOSSAR'2017), Vienna, Austria*, 2017b
26. **S. Marelli** and B. Sudret. Towards the second year milestone: the UQLab development roadmap. In *2nd International Conference on Uncertainty Quantification in Computational Sciences and Engineering (UNCECOMP 2017), 15-17 June 2017, Rhodes Island, Greece*, 2017a. (Talk only)
27. C. Lataniotis, **S. Marelli**, and B. Sudret. Combining dimensionality reduction and surrogate modelling for uncertainty quantification. In *2nd International Conference on Uncertainty Quantification in Computational Sciences and Engineering (UNCECOMP 2017), 15-17 June 2017, Rhodes Island, Greece*, 2017b. (Talk only)
28. E. Torre, **S. Marelli**, P. Embrechts, and B. Sudret. Modelling high-dimensional inputs with copulas for uncertainty quantification problems. In *2nd International Conference on Uncertainty Quantification in Computational Sciences and Engineering (UNCECOMP 2017), 15-17 June 2017, Rhodes Island, Greece*, 2017a. (Talk only)

29. N. Fajraoui, **S. Marelli**, and B. Sudret. Adaptive optimal experimental designs for sparse polynomial chaos expansions. In *2nd International Conference on Uncertainty Quantification in Computational Sciences and Engineering (UNCECOMP 2017), 15-17 June 2017, Rhodes Island, Greece*, 2017b. (Talk only)

30. G. Abbiati, I. Abdallah, **S. Marelli**, B. Sudret, and B. Stojadinovic. Hierarchical Kriging for combining multi-fidelity hybrid and computational simulators. In *7th International Conference on Coupled Problems in Science and Engineering, 12-14 June 2017, Rhodes Island, Greece*, 2017a. (Talk only)

31. C. Lataniotis, **S. Marelli**, and B. Sudret. Dimensionality reduction and surrogate modelling for high-dimensional UQ problems. In *Mascot Num Conference 2017, March 22-24 2017, Paris, France*, 2017a. (Talk only)

32. B. Sudret, **S. Marelli**, and J. Wiart. Surrogate models for uncertainty quantification: An overview. In *Proceedings of the 11th European Conference on Antennas and Propagation (EUCAP), 19-24 March 2017, Paris, France*, pages 793–797, 2017

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