

# DR. -ING. ROBERTO ROCCHETTA

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**Nationality:** Italian

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## OVERVIEW

My name is Roberto Rocchetta, currently working as a post-doctoral researcher at the Technical University of Eindhoven in a collaborative project between Philips and the department of mathematics and computer science. I hold a master of science in Energy engineering from the University of Bologna, a master of research in decision-making under risk and uncertainty, and a PhD in reliability engineering, uncertainty quantification and computer science from the University of Liverpool. **My research is highly multidisciplinary** and combines concepts from **system reliability engineering, statistics and mathematics, stochastic optimization, probability theory, and machine learning. This multidisciplinary often generates interesting synergies while doing joint research, allowing transferring my expertise and knowledge to others while learning from them.** My PhD degree, awarded for my thesis "Robust computational methods for resilience, reliability and vulnerability analysis of power grids", dealt with several important aspects of uncertainty quantification and optimization of complex systems and critical infrastructures. After my PhD, and before joining TU/e, I worked in the USA in a collaborative project with the National Institute of Aerospace (NIA) and NASA Langley. There I started developing my new and independent line of research on hybrid (data-driven & model-based) decision making under uncertainty for reliability optimization and analysis. **I am the first author of 10 peer-reviewed journal articles and more than 15 conference papers.** My works generated a notable impact within the research community and, despite being relatively new (2018-2021), already gathered **more than 370 citations** (google scholar). Please refer to the publications and personal web pages for more details.

## WORK EXPERIENCES, VISITING AND INTERSHIPS

<b>Postdoc</b> , TU/e and Philips Electronics, Eindhoven, NL.	15-10-2019	Present
<b>Research Scholar</b> , NIA and NASA Langley, Hampton, VA, USA.	15-01-2019	15-10-2019
<b>Internship</b> , within ARAMIS start-up, Milan, IT.	2017/2018	6 months
<b>Visiting PhD candidate</b> , Energy Science Center ETH, Zurich, SW.	2017	2 months
<b>Visiting PhD candidate</b> , Laboratory of signal and risk analysis, Milan Polytechnic, IT.	2016/17	3 months
<b>Master thesis</b> , Ecole Centrale de Paris, Paris, FR.	2013	6 months

## EDUCATION

<b>Ph.D.</b> at Institute for Risk and Uncertainty, University of Liverpool, UK	2015-2018/19
<b>Master of Research</b> Decision-Making Under Risk and Uncertainty, Liverpool, UK	2014-2015
<b>Bachelor and Master</b> , Energy Engineering University of Bologna, IT	2008-2014

## HONOURS AND AWARDS

**Top 10:** Postdoc best paper award (TU/e)

**Best Score:** ESREL-2020 innovation challenge on PHM in changing environments.

**First Prize:** Mathematical Competitive Game (2017) "Monte Carlo approach to compute the success probability of sending objects to the Moon".

**Second Prize:** Mathematical Competitive Game (2016) 'Uncertainties in GPS Positioning'.

**Top 3 Prize:** for the best Image of Risk Competition, ESREL conference 2017, Portoriz, Slovenia.

**Paper award:** Best presentation (co-author) at the NAFEMS world congress 2015.

## GRANTS, CONSORTIUMS, PROJECTS

(submitted) **Collaborative grant**, Eureka AI 2021, DAIsy **Value(M€): 4**

(submitted) **Fellowship, Humboldt Value(k€): ~60**

(submitted) **Individual (micro) grant**, NWO domain science XS 2021, **Value(k€): 50**

**Postdoctoral grant**, within the project Daytime ITEA 3 (2019-2022), grant 17030, Project **Value(M€): 11**

**Scholarship grant** Master of research and PhD (2015-2019), Liverpool, EPSRC and ESRC Centre for Doctoral Training on Quantification and Management of Risk & Uncertainty in Complex Systems & Environments Grant No. (EP/L015927/1) Project **Value** (£):4,156,383  
**Scholarship:** Mater Thesis Abroad (2012/2013), at Ecole Centrale de Paris, Project **Value(€):** 3100

#### PEER-REVIEWED JOURNAL PUBLICATIONS

1. A. Gray, A. Wimbush, **R. Rocchetta**, M. De Angelis, P. O. Hristov, E. Miralles-Dolz, D. Calleja, "An extended solution to the NASA 2020 UQ challenge: design optimization and uncertainty calibration under mixed sources of aleatory and epistemic uncertainty", (accepted MSSP, spec. issue NASA challenge on optimization under uncertainty 2021)
2. **R. Rocchetta**, Luis G. Crespo, "A scenario optimization approach to reliability-based and risk-based design: soft-constrained modulation of failure probability bounds", Reliability Engineering & System Safety, (accepted 2021)
3. **R. Rocchetta**, Qi Gao, Milan Petkovic, "Soft-constrained interval predictor models and epistemic reliability intervals: a new tool for uncertainty quantification with limited experimental data", Mechanical Systems and Signal Processing, Volume 161, 2021, <https://doi.org/10.1016/j.ymssp.2021.107973> **5-Year Impact Factor: 6.308**, **Scopus citations: 0**
4. **R. Rocchetta**, E. Patelli, "A Post-Contingency Power Flow Emulator for Generalized Probabilistic Risks Assessment of Power Grids", Reliability Engineering & System Safety, Volume 197, May 2020, 106817, <https://doi.org/10.1016/j.ress.2020.106817> **5-Year Impact Factor: 5.159**, **Scopus citations: 3**
5. **Roberto Rocchetta**, Luis G. Crespo, Sean P. Kenny, "A scenario optimization approach to reliability-based design", Reliability Engineering & System Safety, Volume 196, 2020, <https://doi.org/10.1016/j.ress.2019.106755> **5-Year Impact Factor: 5.159**, **Scopus citations: 6**
6. **R. Rocchetta**, M. Compare, L. Bellani, E. Patelli, E. Zio, "A Reinforcement Learning Framework for Optimal Operation and Maintenance of Power Grids", Applied Energy, Volume 241, Pp 291-301, 2019, <https://doi.org/10.1016/j.apenergy.2019.03.027> **5-Year Impact Factor: 9.086**, **Scopus citations: 50**
7. **R. Rocchetta**, E. Patelli, E. Zio, "A Power-Flow Emulator Approach for Resilience Assessment of Repairable Power Grids subject to Weather-Induced Failures and Data Deficiency", Applied Energy, Volume 210, 15, pp 339-350, 2018, <https://doi.org/10.1016/j.apenergy.2017.10.126> **5-Year Impact Factor: 9.086**, **Scopus citations: 35**
8. **R. Rocchetta**, E. Patelli, "Assessment of Power Grid Vulnerabilities Accounting for Stochastic Loads and Model Imprecision", International Journal for Electrical Power & Energy Systems, Volume 98, pp 219-232, 2018, <https://doi.org/10.1016/j.ijepes.2017.11.047> **5-Year Impact Factor: 9.086**, **Scopus citations: 24**
9. **R. Rocchetta**, E. Patelli, M. Broggi, Q. Huchet, "On-Line Bayesian Model Updating for Structural Health Monitoring", Mechanical Systems and Signal Processing, Volume 103, 174 - 195, 2018, <https://doi.org/10.1016/j.ymssp.2017.10.015> **5-Year Impact Factor: 6.308**, **Scopus citations: 40**
10. **R. Rocchetta**, E. Patelli, M. Broggi, "Do we have enough data? Robust reliability via uncertainty quantification", Applied Mathematical Modelling, Volume 54, pp 710-721, 2018, <https://doi.org/10.1016/j.apm.2017.10.020> **5-Year Impact Factor: 3.370**, **Citations: 16**
11. **R. Rocchetta**, Y.F. Li and E. Zio, "Risk Assessment and Risk-Cost Optimization of Distributed Generation Systems Considering Extreme Weather Conditions", Reliability Engineering and System Safety, Volume 136, pp 47 - 61, 2015, <https://doi.org/10.1016/j.ress.2014.11.013> **5-Year Impact Factor: 5.159**, **Scopus citations: 60**

#### PEER-REVIEWED CONFERENCE PUBLICATIONS

1. R. Rocchetta "Scenario theoretic bounds for Extreme Learning Machines: application to reliability-based sequential decision-making", (accepted, ESREL conference September 2021)
2. M. De Angelis, R. Rocchetta, A. Gray, S. Ferson, "Constructing consonant predictive beliefs from data with scenario theory", International Symposium on Imprecise Probabilities: Theories and Applications, July 2021 <https://leo.uqr.es/isipta21/pmlr/deangelis21.pdf>
3. A. Gray, A. Wimbush, R. Rocchetta, M. De Angelis, P. O. Hristov, E. Miralles-Dolz, D. Calleja, "Bayesian calibration and probability bounds analysis: solution to the Nasa 2020 UQ challenge on optimization under uncertainty", Proceedings of the 30th ESREL and the 15th PSAM Conferences, 2020. <https://www.rpsonline.com.sg/proceedings/esrel2020/pdf/5520.pdf>
4. R. Rocchetta, L. G. Crespo, "An empirical approach to reliability-based design using scenario optimization", Proceedings of the 30th ESREL and the 15th PSAM Conferences, 2020 <https://www.rpsonline.com.sg/proceedings/esrel2020/pdf/4775.pdf>

5. R. Rocchetta, M. Compare, E. Patelli, L. Bellani, E. Zio, "A reinforcement learning framework for optimisation of power grid operations and maintenance", 8<sup>th</sup> international workshop on reliable engineering computing, REC 2018, Liverpool, UK, July, 2018.
6. R. Rocchetta, E. Patelli, "Stochastic Analysis and Reliability-Cost Optimization of Distributed Generators and Air Source Heat Pumps", to be presented at the 2nd International Conference on System Reliability and Safety, ICSRS, 2017, [10.1109/ICSRS.2017.8272792](https://doi.org/10.1109/ICSRS.2017.8272792)
7. R. Rocchetta, E. Patelli, "An Efficient Framework for Reliability Assessment of Power Networks Installing Renewable Generators and Subject to Parametric P-box Uncertainty", Proceedings of the 27th ESREL conference, <https://www.taylorfrancis.com/books/9781315210469>
8. R. Rocchetta, E. Patelli, "Power Grid Robustness to Severe Failures: Topological and Flow Based Metrics Comparison", European Congress on Computational Methods in Applied Sciences and Engineering, ECCOMAS, Crete 2016, pp. 6121-6135.
9. R. Rocchetta, E. Patelli, M. Broggi, Q. Huchet, "On Bayesian Approaches for Real-Time Crack Detection", ESREL conference proceedings, Zurich 2015, pp 1929-1936.
10. R. Rocchetta, E. Patelli, "Imprecise Probabilistic Framework for Power Grids Risk Assessment and Sensitivity Analysis", European Safety and Reliability Conference, ESREL, Glasgow 2016.
11. R. Rocchetta, E. Patelli, M. Broggi, "Efficient Epistemic-Aleatory Uncertainty Quantification: Application to the NAFEMS Challenge Problem", NAFEMS World Congress, San Diego, California, USA 21-24 June 2015.
12. R. Rocchetta, E. Patelli, "A Simulation-Based Probabilistic Risk Assessment of Electric Vehicles Control Strategies Accounting Renewable Energy Sources", International Probabilistic Workshop, IPW Liverpool, UK, 4-6 November 2015, pp. 183-198.

#### PAPERS UNDER REVIEW AND WORKING PAPERS (TENTATIVE TITLES)

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1. Ozcel Cangul; Roberto Rocchetta,; Murat Fahrioglu, "Optimal allocation and sizing of distributed solar PV generators: Unit financial impact indicator", (submitted Applied Energy)
2. R. Rocchetta, A. Mey, F. A. Oliehoek, M. Petkovic, Q. Gao "Exploring the link between learnability via compression and complexity and scenario decision-making theory: the case of Support Vector Machine classifiers", (internal review)
3. R. Rocchetta, M. Petkovic, Q. Gao, "Guarantees on Sensitivity and Specificity for Anomaly Detection Support Vector Machine Ensembles", (extension of the conference paper, in progress)
4. R. Rocchetta, et al. "Generalization Error Bounds for Soft-constrained Convex Optimization Programs: application to Interval Predictor Models", (ICCOSAR 2022 submitted)
5. Roberto Rocchetta, "Enhancing the resilience of critical infrastructures: a statistical analysis on spectral clustering and vulnerability metrics for power networks" (with editor, Renewable & Sus Energy Reviews 2021)

#### PHD THESIS AND MASTER THESIS

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1. Rocchetta Roberto, "Computational Frameworks for Power Grid Reliability, Vulnerability and Resilience Analysis", PhD thesis, University of Liverpool. <https://livrepository.liverpool.ac.uk/3034529/>
2. Rocchetta Roberto, "Robust Probabilistic Risk/Safety Analysis of Complex Systems and Critical Infrastructures" <https://cgi.csc.liv.ac.uk/~sven/RobertoRocchettaMRes.pdf>

#### PERSONAL WEB PAGES

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<https://research.tue.nl/en/persons/roberto-rocchetta>  
<https://roberock.github.io/>  
<https://scholar.google.com/citations?user=qMlqumgAAAAJ&hl=en>

## PROFESSIONAL ACTIVITIES, SEMINAR, TEACHING, EDITORIAL ACTIVITIES

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- Topic Board Editor for the journal Mathematics, MDPI
- Technical committee: International Symposium on Reliability Engineering and Risk Management, 2022, Hannover, GER
- Chair: w3-1 contributed section: uncertain systems and robustness at the Dynamic Systems and Control Conference 2019, Grand Summit Hotel, Park City, Utah, USA
- Seminar: March-13-2019 | Accounting for Uncertainty Caused by Lack of Data and Conflicting Knowledge. Robust Reliability via Uncertainty Quantification, National Institute for aerospace (NIA), Hampton, Virginia, USA
- Technical committee local: International Workshop on Reliable Engineering Computing 2018, , Liverpool, UK
- Poster: COSSAN X software for uncertainty quantification , international conference SIAM UQ 2016, EPFL Lausanne
- Reviewer for NOW grants
- Reviewer for the journal Applied Energy, Elsevier
- Reviewer for the International Journal of Electrical Power & Energy Systems, Elsevier
- Reviewer for the journal Mechanical Systems and Signal Processing, Elsevier
- Reviewer for the journal Reliability engineering and system safety, Elsevier
- Reviewer for the journal Engineering Reports, Wiley
- Reviewer for the IET Generation, Transmission & Distribution, Wiley
- Reviewer for the journal Energies, MDPI
- Reviewer for the journal Mathematics, MDPI
- European Safety and Reliability Association, Newsletter ESRA September 2019

## ACADEMIC NETWORK (SELECTED), ADVISORS AND POTENTIAL REFEREES

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1. **Prof. Dr. Edoardo Patelli**, Strathclyde university, former Ph.D, supervisor [edoardo.patelli@strath.ac.uk](mailto:edoardo.patelli@strath.ac.uk)
2. **Dr. Luis G. Crespo**, former advisor at NASA Langley Research Center, [luis.g.crespo@nasa.gov](mailto:luis.g.crespo@nasa.gov)
3. **Prof. Dr. Milan Petkovic**, project coordinator at TU/e and Philips, [m.petkovic@tue.nl](mailto:m.petkovic@tue.nl)
4. **Prof. Dr. Ing- Enrico Zio**, Polytechnic Milan and Mines ParisTech, [enrico.zio@polimi.it](mailto:enrico.zio@polimi.it)
5. **Prof. Dr. Ing- Giovanni Sansavini**, ETH Zurich, [sansavig@ethz.ch](mailto:sansavig@ethz.ch)
6. **Prof. Dr. Ing- Michael Beer**, Leibniz University Hannover, [beer@bauinf.uni-hannover.de](mailto:beer@bauinf.uni-hannover.de)
7. **Prof Dr. Scott Ferson**, chair in risk and uncertainty, Liverpool, [Scott.Ferson@liverpool.ac.uk](mailto:Scott.Ferson@liverpool.ac.uk)

## LANGUAGE

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Italian	Mother tongue
English (IELTS & Cambridge Certificates)	Working proficiency
Dutch	Just started (A0)
Spanish	Basic conversational skills (A1-A2)
French	Basic conversational skills (A1-A2)

## SOFTWARE KNOWLEDGE

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- **Data analysis, simulation and modelling:** MATLAB, Python, Julia.
- **Data based and storage:** Vertica, SQL.
- **Energy systems and multi-physics simulation:** MatPower, COMSOL Multiphysics.
- **Writing, Visualization, Editing:** LaTeX, JabRef, Mendely, Office, Slack, Inkscape.

## KEY WORDS, RESEARCH INTERESTS

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Imprecise probability theory, Uncertainty Quantification; Energy Systems, Complex and Dynamic Systems and Networks, Resilience, Reliability, Vulnerability and Risk, Stochastic Optimization, Machine Learning, Reliability Based Design, assessment of lack of data situations, Power grids, Generalization bounds; .