

CONTACT INFORMATION	<p><i>E-mail:</i> dabi@mit.edu <i>E-mail:</i> dabi@limitcycle.it <i>E-mail (certified):</i> daniele.bigoni@pec.limitcycle.it <i>Website:</i> www.limitcycle.it/dabi/ <i>ORCID:</i> orcid.org/0000-0003-3504-7530 <i>Publons:</i> publons.com/a/1575407</p>
ACTUAL OCCUPATION	<p>Massachusetts Institute of Technology, Cambridge, MA, United States Department of Aeronautics and Astronautics, Uncertainty Quantification group</p> <p style="text-align: right;"><i>Research Scientist</i> Nov. 2018 - Present</p> <ul style="list-style-type: none"> • TransportMaps: development of methodologies and software for Bayesian inference based on optimal transport – funding DOE, USA • ScramjetUQ: uncertainty quantification in LES computations of turbulent multiphase combustion in a scramjet engine – funding DARPA, USA • UNQUESTIONABLE: INRIA-MIT collaboration in the analysis of aspects in sensitivity analysis, data assimilation and reduced order modeling – funding INRIA, FR
SPOKEN LANGUAGES	<p>Italian: native English: full professional proficiency (TOEFL 108/120 obtained on October 14th, 2011) Danish: A2 beginner Portuguese: A1 beginner</p>
RESEARCH INTERESTS	<p>Mathematical analysis, linear algebra, stochastic differential equations, non-linear dynamics, uncertainty quantification, machine learning, data assimilation, optimal transport, design under uncertainty, parallel computing, distributed systems.</p>
EDUCATION	<p>The Technical University of Denmark, 2800 Kgs. Lyngby, Denmark Department of Applied Mathematics and Computer Science</p> <p style="text-align: right;">Ph.D., Applied Mathematics and Computer Science Dec. 2011 - Dec. 2014 Thesis Topic: <i>Uncertainty Quantification with Applications to Engineering Problems</i> Advisers: Assoc. Prof. Allan P. Engsig-Karup and Prof. Jan S. Hesthaven</p> <p>The Technical University of Denmark, 2800 Kgs. Lyngby, Denmark Department of Applied Mathematics and Computer Science</p> <p style="text-align: right;">M.Sc., Mathematical Modeling and Computation, Sept. 2009 - Aug. 2011 Thesis Topic: <i>Curving Dynamics on High Speed Trains</i> Advisers: Assoc. Prof. Allan P. Engsig-Karup and Assoc. Prof. Hans True Area of Study: Non-linear Dynamics, Numerical Methods for Differential Equations</p> <p>Università degli studi di Trento, 38122 Trento, Italy</p> <p style="text-align: right;">B.Sc., Computer Science, Sept. 2005 - Oct. 2008 Thesis Topic: <i>Decentralized Network Analysis: Development and Simulation</i> Adviser: Assoc. Prof. Alberto Montresor Area of Study: Algorithms and Data Structures, Distributed Systems</p>
ACADEMIC EXPERIENCE	<p>Massachusetts Institute of Technology, Cambridge, MA, United States Department of Aeronautics and Astronautics, Uncertainty Quantification group</p> <p style="text-align: right;"><i>Postdoctoral Associate</i> Jun. 2015 - Sept. 2018</p> <p>The Technical University of Denmark, 2800 Kgs. Lyngby, Denmark Department of Applied Mathematics and Computer Science</p> <p style="text-align: right;"><i>Research Assistant</i> Feb. 2015 - March. 2015</p>

Massachusetts Institute of Technology, Cambridge, MA 02139-4307, USA
 Uncertainty Quantification Group in the Department of Aeronautics and Astronautics.

Visiting PhD Student

Jun. 2013-Dec. 2013

Topic: Uncertainty Quantification for advanced engineering applications

PROFESSIONAL
EXPERIENCE

Danish Product Development Ltd., DK-3070 Snekkersten, Denmark

Consultant and Software Developer.

Oct. 2010 - Jun. 2013

Development of the Graphic User Interface of CatSysPD, software for the early diagnosis of Parkinson's disease. Competences:

- National Instrument Software (NIDAQmx)
- Java Native Access (JNA)
- Java Persistence API (JPA)
- Digital Signal Processing

Alstom Transport, Le Creusot, France

Intern aiming the realization of the MSc. thesis.

Mar. 2011 - Aug. 2011

Study of non-linear dynamics on very-high speed trains. Competences:

- Multi-body (non-linear) dynamics

Università degli Studi di Trento, Facoltà di Scienze, Povo (TN), Italy

Technical Support at the Laboratories.

Mar. 2007 - Nov. 2007

Support activity at the laboratories and the offices at the Science Faculty of the University of Trento. Maintenance of the laboratories in the faculties and assistance to the students.

REFERENCES
AVAILABLE TO
CONTACT

Associate Professor **Dr. Youssef M. Marzouk** (e-mail: ymarz@mit.edu)

Department of Aeronautics and Astronautics,
 Massachusetts Institute of Technology
 Room 37-451, 77 Massachusetts Avenue, Cambridge, MA 02139, USA
Dr. Marzouk is my current PostDoc adviser.

Associate Professor **Dr. Allan P. Engsig-Karup** (e-mail: apek@dtu.dk)

Department of Applied Mathematics and Computer Science,
 The Technical University of Denmark
 Matematiktorvet, Building 303b/108, 2800 Kgs.-Lyngby, Denmark
Dr. Engsig-Karup was my graduate adviser.

Associate Professor **Dr. Hans True** (e-mail: htru@dtu.dk)

Applied Mathematics and Computer Science,
 The Technical University of Denmark
 Matematiktorvet, Building 303b/108, 2800 Kgs.-Lyngby, Denmark
Dr. True was my adviser in several projects.

- FUNDING
- 2013: *Otto Mønsted travel grant* \$1200
 - 2013: *Idella foundation travel scholarship* \$2700
 - 2012: *Otto Mønsted travel grant* \$1300
- TEACHING EXPERIENCE
- Massachusetts Institute of Technology**, 02139 Cambridge, MA, USA
Department of Aeronautics and Astronautics
- Teaching Assistant* **Jun. 2015 - Present**
- Oct. - Nov. 2015: 16.940 Numerical Methods for Stochastic Modeling and Inference
- The Technical University of Denmark**, 2800 Kgs. Lyngby, Denmark
Department of Applied Mathematics and Computer Science
- Teaching Assistant* **Dec. 2011 - Dec. 2014**
- Sep. - Dec. 2012: Study in Spectral Methods for solution of Partial Differential Equations
 - Feb. - Mar. 2012: Scientific Computing for differential equations (02685)
 - Jan. 2012: The Finite Element Method for Partial Differential Equations (02623)
- Teaching* **Dec. 2011 - Dec. 2014**
- Mar. - May. 2015: Scientific Computing for differential equations (02685)
 - Feb. - Mar. 2013: Scientific Computing for differential equations (02685)
- STUDENTS SUPERVISION
- The Technical University of Denmark**, 2800 Kgs. Lyngby, Denmark
Department of Applied Mathematics and Computer Science
- Master Thesis*
- Sep. 2015 - Feb. 2016: Kristian Berg Thomsen *Theory and application of the Multilevel Monte Carlo method* (co-supervisor)
 - Feb. 2015 - Aug. 2015: Andreas F. Mieritz *Robust massively parallel free surface simulation using the Spectral Element Method* (co-supervisor)
 - Nov. 2014 - Apr. 2015: Claus L. Jensen *Reduced Order Modeling for Partial Differential Equation* (co-supervisor)
 - Dec. 2012 - May. 2013: Emil B. Kærgaard *Spectral Methods for Uncertainty Quantification* (co-supervisor)
 - Dec. 2012 - May. 2013: Emil K. Nielsen *Study in Modern Uncertainty Quantification Methods* (co-supervisor)
- Bachelor Thesis*
- Sep. 2012 - Feb. 2013: Christian H. Brams *Spectral Methods for Uncertainty Quantification* (co-supervisor)
- Projects*
- Feb. - May. 2014: Bachelor project in modeling and simulation of railway vehicle dynamics (co-supervisor)
 - Feb. - May. 2013: Bachelor project in modeling and simulation of railway vehicle dynamics (co-supervisor)
- SERVICE
- Massachusetts Institute of Technology**, 02139 Cambridge, MA, USA
Department of Aeronautics and Astronautics
- Organization of reading groups* **2015-present**
- The Technical University of Denmark**, 2800 Kgs. Lyngby, Denmark
Department of Applied Mathematics and Computer Science
- Organization of the Ph.D. seminar series* **2014-2015**

REFeree
SERVICE

- *Vehicle System Dynamics* – Taylor & Francis
- *Journal of Rail and Rapid Transit* – Sage journals
- *Computers & Fluids* – Elsevier
- *Journal of Computational Physics* – Elsevier
- *Mathematics and Computers in Simulation* – Elsevier
- *Transactions on Emerging Topics in Computing* – IEEE
- *Transactions on Mathematical Software* – ACM
- *Annual Conference on Neural Information Processing Systems*
- *Proceedings of the Royal Society A*

CONFERENCE
SERVICE

- (2018) Organizer of mini-symposium: Dimension reduction in Bayesian inference. In *SIAM conference in Uncertainty Quantification*, Garden Grove, CA, USA.
- (2017) Co-organizer of mini-symposium: Measure Transport Approaches for Statistical Problems. In *SIAM conference in Computational Science and Engineering*, Atlanta, GA, USA

THESIS
DISSERTATIONS

- Bigoni, D.** (2015). *Uncertainty Quantification with Applications to Engineering Problems*. Technical University of Denmark. PhD Thesis
- Bigoni, D.** (2011). *Curving Dynamics on High Speed Trains*. Technical University of Denmark. Master Thesis.
- Bigoni, D.** (2008). *Decentralized Network Analysis: Development and Simulation*. Università degli studi di Trento. Bachelor Thesis.

REFEREED
JOURNAL
PUBLICATIONS

- Spantini, Alessio, **Daniele Bigoni**, and Youssef Marzouk (2018). "Inference via low-dimensional couplings". In: *Journal of Machine Learning Research* 19.66, pp. 1–71. arXiv: 1703.06131.
- Bigoni, D.**, A. P. Engsig-Karup, and C. Eskilsson (2016). "Efficient uncertainty quantification of a fully nonlinear and dispersive water wave model with random inputs". In: *Journal of Engineering Mathematics*. ISSN: 0022-0833. DOI: 10.1007/s10665-016-9848-8. arXiv: 1410.6338.
- Bigoni, D.**, A. P. Engsig-Karup, and Y. Marzouk (Jan. 2016). "Spectral Tensor-Train Decomposition". In: *SIAM Journal on Scientific Computing* 38.4, A2405–A2439. ISSN: 1064-8275. DOI: 10.1137/15M1036919. arXiv: 1405.5713.
- Engsig-Karup, A.P., C. Eskilsson, and **D. Bigoni** (Aug. 2016). "A stabilised nodal spectral element method for fully nonlinear water waves". In: *Journal of Computational Physics* 318, pp. 1–21. ISSN: 00219991. DOI: 10.1016/j.jcp.2016.04.060. arXiv: 1512.02548.
- Bigoni, D.**, H. True, and A.P. Engsig-Karup (Apr. 2014). "Sensitivity analysis of the critical speed in railway vehicle dynamics". In: *Vehicle System Dynamics* May 2014, pp. 272–286. ISSN: 0042-3114. DOI: 10.1080/00423114.2014.898776.
- True, H., A.P. Engsig-Karup, and **D. Bigoni** (Jan. 2014). "On the numerical and computational aspects of non-smoothnesses that occur in railway vehicle dynamics". In: *Mathematics and Computers in Simulation* 95, pp. 78–97. ISSN: 03784754. DOI: 10.1016/j.matcom.2012.09.016.

REFEREED
CONFERENCE
PUBLICATIONS

- Engsig-Karup, A. P., C. Eskilsson, and **D. Bigoni** (2016). "Unstructured Spectral Element Model for Dispersive and Nonlinear Wave Propagation". In: *The 26th International Ocean and Polar Engineering Conference*. Rhodes, Greece.
- Bigoni, D.**, A. P. Engsig-Karup, and H. True (July 2014). "Global Sensitivity Analysis of Railway Vehicle Dynamics on Curved Tracks". In: *Volume 2: Dynamics, Vibration and Control; Energy; Fluids Engineering; Micro and Nano Manufacturing*. Copenhagen, Denmark: ASME, V002T07A023. ISBN: 978-0-7918-4584-4. DOI: 10.1115/ESDA2014-20529.
- Bigoni, D.**, A. P. Engsig-Karup, and H. True (2013a). "Anwendung der Uncertainty Quantification bei eisenbahndynamischen problemen". In: *Z E Vrail - Glasers Annalen* 137.SPL.ISSUE, pp. 152–158. ISSN: 1618-8330.
- (Oct. 2013b). "Modern Uncertainty Quantification Methods in Railroad Vehicle Dynamics". In: *ASME 2013 Rail Transportation Division Fall Technical Conference*. Altoona: ASME, V001T01A009. ISBN: 978-0-7918-5611-6. DOI: 10.1115/RTDF2013-4713.
- Bigoni, D.**, H. True, and A. P. Engsig-Karup (2013). "Sensitivity Analysis of the critical speed in railway vehicle dynamics". In: *23rd IAVSD Symposium on Dynamics of Vehicles on Roads and Tracks*. Qingdao.
- Bigoni, D.**, A.P. Engsig-Karup, and H. True (2012). "Comparison of Classical and Modern Uncertainty Quantification Methods for the Calculation of Critical Speeds in Railway Vehicle Dynamics". In: *13th mini Conference on Vehicle System Dynamics, Identification and Anomalies*. Budapest, Hungary.

CONFERENCE
ACTIVITIES

- D. Bigoni***, R. Baptista, A. Spantini, Y. Marzouk (2018) Variational Bayesian filtering and smoothing via low-dimensional transports. In *AGU Fall Meeting*. Washington, MA, USA (Talk)
- D. Bigoni***, A. Spantini, Y. Marzouk (2018) Ordering heuristics for tensor-train decomposition. In *SIAM Annual Meeting*. Portland, OR, USA (Talk)

- D. **Bigoni**^{*}, A. Spantini, Y. Marzouk (2018) Adaptive construction of Transport-Maps for efficient sampling. In *13th International Conference in Monte Carlo and Quasi-Monte Carlo Methods in Scientific Computing*. Rennes, France (Talk)
- D. **Bigoni**^{*}, A. Spantini, R. Morrison, R. Baptista, Y. Marzouk (2018) Bayesian Inference and Statistical Modeling with TransportMaps. In *SIAM Conference on Uncertainty Quantification*. Garden Grove, CA, USA (Poster)
- D. **Bigoni**^{*}, A. Spantini, Y. Marzouk (2018) Scalable Inference with Transport Maps. In *SIAM Conference on Uncertainty Quantification*. Garden Grove, CA, USA (Talk)
- D. **Bigoni**^{*}, A. Spantini, Y.M. Marzouk. (2017) Measure transport approaches to uncertainty quantification. In *QUIET17: Quantification of Uncertainty: Improving Efficiency and Technology*. Trieste, Italy (Poster)
- D. **Bigoni**^{*}, A. Spantini, Y.M. Marzouk. (2017) An Automated Measure Transport Framework for Online Nonlinear Filtering and Smoothing. In *SIAM Annual Meeting*. Pittsburgh, PA, USA. (Talk)
- D. **Bigoni**^{*}, A. Spantini, Y.M. Marzouk. (2017) Robust and Adaptive Construction of Measure Transports for Bayesian Inference. In *SIAM conference in Computational Science and Engineering*. Atlanta, GA, USA. (Talk)
- A. Spantini^{*}, D. **Bigoni**, Y.M. Marzouk. (2017) Bayesian Filtering and Smoothing Via Measure Transport. In *SIAM conference in Computational Science and Engineering*. Atlanta, GA, USA. (Talk)
- D. **Bigoni**^{*}, A. Spantini, Y.M. Marzouk. (2016) Adaptive construction of measure transports for Bayesian inference. In *Annual Conference on Neural Information Processing Systems - Advances in Approximate Bayesian Inference*. Barcelona, Spain. (Paper, Poster)
- A. Spantini^{*}, D. **Bigoni**, Y.M. Marzouk. (2016) Variational inference via decomposable transports: algorithms for Bayesian filtering and smoothing. In *Annual Conference on Neural Information Processing Systems - Advances in Approximate Bayesian Inference*. Barcelona, Spain. (Paper, Poster)
- D. **Bigoni**^{*}, A. Spantini, Y.M. Marzouk. (2016) Adaptive construction of measure transports, with application to Bayesian inference. In *Bi-annual congress of the Italian Society of Industrial and Applied Mathematics (SIMAI)*. Milan, Italy. (Talk)
- A. Spantini^{*}, D. **Bigoni**, Y.M. Marzouk. (2016) Measure transport, inference and low-dimensional maps. In *Bi-annual congress of the Italian Society of Industrial and Applied Mathematics (SIMAI)*. Milan, Italy. (Talk)
- D. **Bigoni**^{*}, Y.M. Marzouk. (2016) Ordering Heuristics for Minimal Rank Approximations in Tensor-Train Format. In *SIAM Conference on Uncertainty Quantification*. Lausanne, Switzerland. (Talk)
- D. **Bigoni**^{*}, Y.M. Marzouk, A.P. Engsig-Karup. (2015) Adaptive spectral tensor-train decomposition. In *13th U.S. National Congress on Computational Mechanics*. San Diego, California, USA. (Talk)
- D. **Bigoni**^{*}, A.P. Engsig-Karup, C. Eskilsson. (2015) Towards non-linear wave models with random inputs. In *SIAM Conference on Mathematical and Computational Issues in Geosciences*. Stanford University, California, USA. (Talk)
- A.P. Engsig-Karup^{*}, C. Eskilsson, D. **Bigoni**. (2015) Towards Uncertain Hydrodynamic Loads on Offshore Wind Turbines By Spectral Methods. In *2nd Frontiers in Computational Physics Conference: Energy Sciences*. Zurich, Switzerland. (Talk)
- D. **Bigoni**^{*}, A.P. Engsig-Karup, Y.M. Marzouk. (2015) Adaptive spectral tensor-train decomposition for the construction of surrogate models. In *SIAM conference on Computational Science and Engineering*. Salt Lake City, Utah, USA. (Poster presentation)
- A.P. Engsig-Karup^{*}, D. **Bigoni**, C. Eskilsson. (2015) A spectral element method for nonlinear and dispersive water waves. In *SIAM conference on Computational Science and Engineering*. Salt Lake City, Utah, USA. (Poster presentation)
- D. **Bigoni**^{*}, A.P. Engsig-Karup, Y.M. Marzouk. (2014) Spectral tensor-train decomposition for low-rank surrogate models. In *Workshop on Spatial Statistics and Uncertainty Quantification on Supercomputers*. Bath, United Kingdom. (Poster presentation)
- D. **Bigoni**^{*}, A.P. Engsig-Karup, Y.M. Marzouk. (2014) Surrogate models for uncertainty quantification via spectral tensor-train decomposition. In *Workshop on Uncertainty Quantification in Computational Fluid Dynamics*. Pisa, Italy. (Talk)
- D. **Bigoni**^{*}, A.P. Engsig-Karup, H. True. (2014) Global sensitivity analysis of Railway

Vehicle Dynamics on curved tracks. In proceeding of *ASME 2014 12th Biennial Conference on Engineering Systems Design and Analysis*. Copenhagen, Denmark. (Talk and proceeding)

A.P. Engsig-Karup*, **D. Bigoni**, S.L. Glimberg (2013) Stochastic Wave Dynamics and Uncertainty Quantification. In *38th Woudschoten Conference*. Zeist, Netherlands. (Poster presentation)

D. Bigoni*, A.P. Engsig-Karup, H. True. Modern uncertainty quantification methods in railroad vehicle dynamics. In proceeding of *ASME 2013 Rail Transportation Division Fall Technical Conference*. Oct 2013, Altoona, Pennsylvania, USA. (Talk and proceeding)

D. Bigoni*, A.P. Engsig-Karup, H. True. Sensitivity analysis of the critical speed in railway vehicle dynamics. In proceeding of *23rd International Symposium on Dynamics of Vehicles on Roads and Tracks (IAVSD2013)*. Aug 2013, Qingdao, China. (Talk and proceeding)

D. Bigoni*, A.P. Engsig-Karup, H. True. Comparison of Classical and Modern Uncertainty Quantification Methods for the Calculation of Critical Speeds in Railway Vehicle Dynamics. *13th Mini Conference on Vehicle System Dynamics, Identification and Anomalies*. Nov 5-7, 2012 at Budapest University of Technology and Economics, Hungary. (Talk and proceeding)

D. Bigoni*, A.P. Engsig-Karup, H. True, J.S. Hesthaven. Uncertainty quantification of critical speed for railway vehicle dynamics. *BIT Circus 2012*. Aug 23-24, 2012 at DTU, Denmark. (Talk)

D. Bigoni*, A.P. Engsig-Karup, H. True. Uncertainty Quantification on High-speed Railway Dynamics. *Uncertainty Quantification for High-Performance Computing Workshop*. May 2-4, 2012 at ORNL in Oak Ridge (TN), USA. (Poster presentation)

SOFTWARE
DEVELOPMENT

- [TransportMaps](#) (Python): measure transport for statistical inference and estimation.
- [SpectralToolbox](#) (Python): construction of basis functions for spectral approximations.
- [UQToolbox](#) (Python): methods for Uncertainty Quantification.
- [TensorToolbox](#) (Python): methods for low-rank tensor decomposition.
- [mpi_map](#) & [phantom_scheduler](#) (Python): routines for parallel and cluster computing.
- [DYTSI](#) (C++): DYnamic Train Simulation for railway vehicle dynamics.