

CONTACT  
INFORMATION

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*Website:* <http://www.limitcycle.it/dabi/>

PERSONAL  
INFORMATION

*Born in* Ravenna (RA), 48121, Italy on June 16<sup>th</sup>, 1986  
*Citizenship:* Italian

ACTUAL  
OCCUPATION

**Massachusetts Institute of Technology**, Cambridge, MA, United States  
 Department of Aeronautics and Astronautics, Uncertainty Quantification group  
*Postdoctoral Associate* **Jun. 2015 - Present**

SPOKEN  
LANGUAGES

Italian: native  
 English: full professional proficiency (TOEFL 108/120 obtained on October 14<sup>th</sup>, 2011)  
 Danish: A2 beginner  
 Portuguese: A1 beginner

RESEARCH  
INTERESTS

Mathematical Analysis, Linear Algebra, Stochastic Differential Equations, Non-linear Dynamical Systems, Uncertainty Quantification, Machine Learning, Digital Signal Processing, Massively Parallel Computing, Distributed Systems.

## EDUCATION

**The Technical University of Denmark**, 2800 Kgs. Lyngby, Denmark  
 Department of Applied Mathematics and Computer Science  
 Ph.D., Applied Mathematics and Computer Science Dec. 2011 - Dec. 2014  
 Thesis Topic: *Uncertainty Quantification for advanced engineering applications*  
 Advisers: Assoc. Prof. Allan P. Engsig-Karup and Prof. Jan S. Hesthaven

**The Technical University of Denmark**, 2800 Kgs. Lyngby, Denmark  
 Department of Applied Mathematics and Computer Science  
 M.Sc., Mathematical Modeling and Computation, September 2009 - August 2011  
 Thesis Topic: *Curving Dynamics on High Speed Trains*  
 Advisers: Assoc. Prof. Allan P. Engsig-Karup and Assoc. Prof. Hans True  
 Area of Study: Non-linear Dynamics, Numerical Methods for Differential Equations

**Università degli studi di Trento**, 38122 Trento, Italy  
 B.Sc., Computer Science, September 2005 - October 2008  
 Thesis Topic: *Decentralized Network Analysis: Development and Simulation*  
 Adviser: Assoc. Prof. Alberto Montresor  
 Area of Study: Algorithms and Data Structures, Distributed Systems

ACADEMIC  
EXPERIENCE

**The Technical University of Denmark**, 2800 Kgs. Lyngby, Denmark  
 Department of Applied Mathematics and Computer Science  
*Research Assistant* **Feb. 2015 - March. 2015**

**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.

## SERVICE

**Ravenna Linux User Group**, Ravenna, Italy*Participation to the activities***2000-2005**

Participation and organization of the activities of the LUG.

HARDWARE AND  
SOFTWARE  
SKILLS

Instrumentation, Control, Data Acquisition, Test and Measurement:

- **National Instruments** control and data acquisition hardware and software.

Computer Programming:

- C, C++, Java, OCaml, CUDA C, Pascal, PHP, UNIX shell scripting, GNU make, SQL, MySQL, MATLAB, Python, Maple, Mathematica, R.

Version Control and Software Configuration Management:

- DVCS (Bazaar, Mercurial, Git), VCS (CVS, SVN)

Productivity Applications:

- $\text{\TeX}$  ( $\text{\LaTeX}$ ,  $\text{\BibTeX}$ )
- Most common office suites: LibreOffice, Microsoft Office.

Operating Systems:

- Microsoft Windows family, Apple OS X, Linux and other UNIX variants.

## EXPERTISE

Mathematics:

- Applied Mathematics, Real and Complex Analysis, Functional Analysis, Measure Theory, Non-linear dynamics, Differential Geometry, Statistics and Probability theory, Numerical Methods for Differential Equations (Finite Elements, Finite Differences, Finite Volume, Discontinuous Galerkin)

Computer Science and Engineering:

- Software Engineering, Software Validation and Verification, High Performance Computing, Distributed Systems.

Physics:

- Mechanical physics, multi-body dynamics, fluid mechanics

REFERENCES  
AVAILABLE TO  
CONTACTAssociate Professor **Dr. Yousef 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](mailto: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](mailto: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.*

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
- *IEEE Transactions on Emerging Topics in Computing*
- *ACM Transactions on Mathematical Software*
- *Annual Conference on Neural Information Processing Systems*

CONFERENCE  
SERVICE

- (2018) Co-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.
- PREPRINTS
- A. Spantini, D. Bigoni, Y. Marzouk (2017). "Inference via low-dimensional couplings". In: *ArXiv e-prints*. arXiv: 1703.06131 [stat.ME].
- REFEREED  
JOURNAL  
PUBLICATIONS
- D. Bigoni**, A. P. Engsig-Karup, 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.
- D. Bigoni**, A. P. Engsig-Karup, Y. M. Marzouk (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.
- A. Engsig-Karup, C. Eskilsson, **D. Bigoni** (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.
- D. Bigoni**, H. True, A. Engsig-Karup (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.
- H. True, A. Engsig-Karup, **D. Bigoni** (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
- A. P. Engsig-Karup, C. Eskilsson, **D. Bigoni** (2016). "Unstructured Spectral Element Model for Dispersive and Nonlinear Wave Propagation". In: *The 26th International Ocean and Polar Engineering Conference*. Rhodes, Greece.
- D. Bigoni**, A. P. Engsig-Karup, H. True (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.
- D. Bigoni**, A. P. Engsig-Karup, H. True (2013). "Modern Uncertainty Quantification Methods in Railroad Vehicle Dynamics". In: *ASME 2013 Rail Transportation Division Fall Technical Conference*. Altona: ASME, V001T01A009. ISBN: 978-0-7918-5611-6. DOI: 10.1115/RTDF2013-4713.
- D. Bigoni**, A. P. Engsig-Karup, H. True (2013). "Anwendung der Uncertainty Quantification bei eisenbahndynamischen problemen". In: *Z E Vrail - Glasers Annalen* 137.SPL.ISSUE, pp. 152–158. ISSN: 1618-8330.
- D. Bigoni**, H. True, 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.
- D. Bigoni**, A. Engsig-Karup, 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\***, 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**<sup>\*</sup>, 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<sup>\*</sup>, 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**<sup>\*</sup>, 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<sup>\*</sup>, 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**<sup>\*</sup>, 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<sup>\*</sup>, 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**<sup>\*</sup>, 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**<sup>\*</sup>, 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**<sup>\*</sup>, 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<sup>\*</sup>, 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**<sup>\*</sup>, 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<sup>\*</sup>, 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**<sup>\*</sup>, 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**<sup>\*</sup>, 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**<sup>\*</sup>, 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<sup>\*</sup>, D. **Bigoni**, S.L. Glimberg (2013) Stochastic Wave Dynamics and Uncertainty Quantification. In *38th Woudschoten Conference*. Zeist, Netherlands. (Poster presentation)
- D. **Bigoni**<sup>\*</sup>, 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**<sup>\*</sup>, 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**<sup>\*</sup>, 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)