

Alex A. Gorodetsky

CONTACT INFORMATION	Department of Aerospace Engineering University of Michigan 3053 FXB 1320 Beal Avenue Ann Arbor, MI, 48109, USA	<i>email:</i> goroda@umich.edu <i>email:</i> alex@alexgorodetsky.com <i>web:</i> www.alexgorodetsky.com
RESEARCH INTERESTS	Decision making under uncertainty: Uncertainty quantification, autonomous systems, Bayesian inference, statistics, data analysis, machine learning, numerical analysis, tensor methods, stochastic optimal control and optimization, mathematical modeling	
EDUCATION	Massachusetts Institute of Technology , Cambridge, MA Ph.D., Department of Aeronautics and Astronautics, February 2017 <ul style="list-style-type: none">• Thesis: <i>Continuous low-rank tensor decompositions, with applications to stochastic optimal control and data assimilation</i>• Advisers: Professor Sertac Karaman, Professor Youssef M. Marzouk• Areas of Study: Computational Science, Control, Autonomy S.M., Department of Aeronautics and Astronautics, June 2012 <ul style="list-style-type: none">• Thesis: <i>A learning method for the approximation of discontinuous functions for stochastic simulations</i>• Adviser: Professor Youssef M. Marzouk• Area of Study: Computational Science University of Michigan , Ann Arbor, MI B.S.E., Aerospace Engineering, June 2010 <ul style="list-style-type: none">• <i>Summa cum Laude</i>• Minor in Mathematics	
AWARDS	<ul style="list-style-type: none">• Air Force Office of Scientific Research Young Investigator Award (2018)• John von Neumann Postdoctoral Research Fellowship in Computational Science 2016• Department of Energy Office of Science Graduate Fellowship (DOE SCGF), Finalist, 2012	
PROFESSIONAL EXPERIENCE	Sandia National Laboratories , Albuquerque, NM <i>John von Neumann Postdoctoral Fellow</i> October 2016 – December 2017 <i>Optimization and Uncertainty Quantification Group</i> <i>Computer Science Research Institute</i> Massachusetts Institute of Technology , Cambridge, MA <i>Graduate Research Assistant</i> September 2010 – September 2016 <i>Aerospace Computational Design Laboratory</i>	
JOURNAL PUBLICATIONS	<ul style="list-style-type: none">[1] Rai, P., Kolla, H, Cannada, L., Gorodetsky, A.A., Randomized functional sparse Tucker tensor for compression and fast visualization of scientific data. <i>Submitted</i>[2] Jakeman, J., Eldred, M. S., Geraci, G., Gorodetsky, A.A. Adaptive multi-index collocation for uncertainty quantification and sensitivity analysis. <i>Submitted</i>[3] Alben, S., Gorodetsky, A. A., Kim, D., Deegan, R. D. Semi-implicit methods for the dynamics of elastic sheets. <i>In Press. Journal of Computational Physics</i>	

- [4] Gorodetsky, A. A., Geraci, G., Eldred M. S., Jakeman, J. A generalized framework for approximate control variates. *Submitted*
- [5] Wildey, T., Gorodetsky, A.A., Belme, A.C., Shadid, J. N., Robust Uncertainty Quantification using response surface approximations of discontinuous functions *Forthcoming, International Journal of Uncertainty Quantification*.
- [6] Gorodetsky A. A., Jakeman, J. D. Gradient-based Optimization for Regression in the Functional Tensor-Train Format. *Journal of Computational Physics*, 374 (2018): 1219-1238
- [7] Gorodetsky A. A., Karaman, S., and Marzouk Y. M. A continuous analogue of the tensor-train decomposition. *Computer Methods in Applied Mechanics and Engineering*, 347 (2018): 59-94
- [8] Kramer, B., and Gorodetsky, A. System identification via CUR-factored Hankel approximation. *SIAM Journal on Scientific Computing* 40.2 (2018): A848-A866
- [9] Gorodetsky A. A., Karaman, S., and Marzouk Y. M. High-dimensional stochastic optimal control using continuous tensor decompositions. *International Journal of Robotics Research*, 37.2-3 (2018): 340-377
- [10] Gorodetsky, A. A., and Marzouk, Y. M. Mercer kernels and integrated variance experimental design: connections between Gaussian process regression and polynomial approximation *SIAM/ASA Journal on Uncertainty Quantification*, 4:1 (2016): 796-828
- [11] Gorodetsky, A. A., and Marzouk, Y. M. Efficient localization of discontinuities in complex computational simulations. *SIAM Journal on Scientific Computing*, 36.6 (2014): A2584-A2610
- [12] Eldred, M. S., Geraci, G., Gorodetsky, A., and Jakeman, J. Recent advancements in Multilevel-Multifidelity techniques for forward UQ in the DARPA SEQUOIA project. *AIAA Scitech Forum* 2019.
- [13] Geraci, G., Eldred, M.S., Gorodetsky, A. A., Jakeman J. Leveraging Active Subspaces for Efficient Multifidelity Uncertainty QUantification. *ECCM-ECCFD 2018*, Glasgow, Scotland, UK 2018.
- [14] Tal, E., Gorodetsky, A. A, Karaman, S. Continuous Tensor Train-Based Dynamic Programming for High-Dimensional Zero-Sum Differential Games. *American Control Conference (ACC)*, Milwaukee, WI, USA, 2018.
- [15] Sayre-McCord, R. T., Guerra, W., Antonini, A., Arneberg, J., Brown, A., Cavalheiro, G., Fang, Y., Gorodetsky, A., McCoy, D., Quilter, S., Riether, F., Tal, E., Terzioglu, Y., Carlone, L., Karaman, S. Visual-inertial navigation algorithm development using photorealistic camera simulation in the loop. *Proceedings of the IEEE International Conference on Robotics and Automation (ICRA)*, Brisbane, Australia, 2018.
- [16] Eldred, M. S., Geraci, G., Gorodetsky, A., and Jakeman, J. Multilevel-Multifidelity Approaches for Forward UQ in the DARPA SEQUOIA project. *2018 AIAA Non-Deterministic Approaches Conference*. 2018.
- [17] Gorodetsky, A., Karaman S., and Marzouk, Y. M. Low-rank tensor integration for Gaussian filtering of continuous time nonlinear systems In: *56th IEEE Conference on Decision and Control*, Melbourne, Australia, December, 2017.
- [18] Alora, J., Gorodetsky, A., Karaman S., Lowry, N., and Marzouk, Y. M. Automated synthesis of low-rank control systems from sc-LTL specifications using tensor-train decompositions In: *55th IEEE Conference on Decision and Control*, Las Vegas, NV, USA, December, 2016.

REFEREED
CONFERENCE
PUBLICATIONS

SELECTED
CONFERENCE
TALKS

- [19] Gorodetsky, A., Karaman S., and Marzouk, Y. M. Efficient high-dimensional stochastic optimal motion control using tensor-train decomposition. In: *Proceedings of Robotics: Science and Systems*, Rome, Italy, July, 2015.
- [20] Gorodetsky, A., Geraci, G., Eldred, M., Jakeman J. Unifying Multifidelity Sampling Approaches as Approximate Control Variates. In *US National Congress on Computational Mechanics*, Austin, TX, USA, July 28 – August 1, 2019.
- [21] Gorodetsky, A. and Mathelin, L. New Approaches to Learn Low-rank Models of Dynamical Systems From Streaming Data. In *3rd International Conference on Uncertainty Quantification in Computational Sciences and Engineering (UNCECOMP 2019)* Crete, Greece, June 24 – 26, 2019
- [22] Gorodetsky, A., Jakeman, J., Mathlin, L., Pivot C. Learning Strategies for Generating Low-Rank Representations of Physical Systems. In *SIAM Conference on Computational Science and Engineering* Spokane, WA, USA, February 24 – March 1, 2019.
- [23] Gorodetsky, A., Geraci, G., Eldred, M., Jakeman J. Multifidelity Model Management using Latent Variable Bayesian Networks. In *World Congress on Computational Mechanics*, New York, NY, USA, July 22 – 27, 2018.
- [24] Gorodetsky, A., Geraci, G., Eldred, M., Jakeman J. Multifidelity Model Management using Latent Variable Bayesian Networks. In *SIAM Annual Conference*, Portland, OR, USA July 9 – 15, 2018.
- [25] Gorodetsky, A., Geraci, G., Eldred, M., Jakeman J. Latent Variable Networks for Multifidelity Uncertainty Quantification In *ECCM-ECFD*, Glasgow, Scotland, UK, June 11 – 15, 2018.
- [26] Gorodetsky, A., Geraci, G., Eldred, M., Jakeman J. Multifidelity Model Management using Latent Variable Bayesian Networks. In *SIAM Conference on Uncertainty Quantification*, Los Angeles, CA, USA, April 15 – 19, 2018.
- [27] Gorodetsky, A., Geraci, G., Eldred, M., Jakeman J. Multifidelity Model Management using Latent Variable Bayesian Networks. In *2nd Physics Inspired Machine Learning Conference*, Santa Fe, NM, USA, January 21 – 25, 2018.
- [28] Gorodetsky, A. Low rank functional decompositions, with application to stochastic optimal control. In: *2017 Meeting of the International Linear Algebra Society*, Ames, IA, USA, July 24 – July 28 2017.
- [29] Gorodetsky, A. Exploiting low-rank structure in stochastic optimal control and filtering problems. In: *SIAM Conference on Control and its Applications*, Pittsburgh, PA, USA, July 10 – July 12 2017.
- [30] Gorodetsky, A. and Jakeman J. D. Continuous alternating least squares for regression of low-rank functions. In: *SIAM Conference on Computational Science and Engineering*, Atlanta, GA, USA, February 27 – March 3 2017.
- [31] Tensor decompositions and their UQ applications. In *USC Summer School on Uncertainty Quantification*, Los Angeles, CA, USA, August 14-16, 2019
- [32] Compression algorithms for enabling high-dimensional motion planning. In *LIMSI-CNRS*, Orsay, France, June 20, 2019.
- [33] Compression algorithms for enabling high-dimensional motion planning. In *Sandia National Laboratories*, Albuquerque, NM, May 23, 2019.
- [34] Exploiting and learning structure for multifidelity UQ. In *U2CanUQ conference*, University of Arizona, Tuscon, Arizona, USA, April 10, 2019. **Keynote.**

- [35] Multifidelity uncertainty quantification through approximate control variates and Bayesian networks. In *University of Notre Dame, Department of Applied Mathematics*, Notre Dame, Indiana, USA, November 15, 2018.
- [36] Low-rank tensor approaches for adaptive function approximation: algorithms and examples. In *University of Michigan Applied Mathematics Seminar*, Ann Arbor, MI, USA, September 7, 2018.
- [37] Modeling connections between multifidelity information sources for uncertainty quantification. In *UTRC*, Hartford, CT, USA, August 20 – 21, 2018.
- [38] Functional tensor-train approach and algorithms. In *Yale, Department of Chemistry*, New Haven, CT, USA, August 13-16, 2018.
- [39] Regression in low-rank functional formats. In *USC Workshop on Scientific Machine Learning*, Los Angeles, CA, USA, June 4–6, 2018.
- [40] Compression for stochastic optimal control. In *Los Alamos National Laboratory.*, Los Alamos, NM, USA, June 20, 2017.
- [41] Real-time control and uncertainty quantification of autonomous systems using low-rank multilinear compression. In *University of Michigan Aerospace Engineering Seminar*, Ann Arbor, MI, USA, April 12, 2017.
- [42] Low-rank computation for optimal stochastic control and function approximation. In *MIT Aerospace Computational Design Laboratory Seminar*, Cambridge, MA, USA, November 3, 2015.

OPEN SOURCE
SOFTWARE

GPEXP: Experimental design for Gaussian process regression

- Python package for performing experimental design for Gaussian process models
- Github source code: <https://github.com/goroda/GPEXP>

C³: Compressed Continuous Computation

- Library for computing with multidimensional functions in a compressed format
- Has utilities to aid computation in the context of control, optimization, probabilistic inference, multilinear algebra, and integration
- Github source code: <https://github.com/goroda/Compressed-Continuous-Computation>

C³SC: Compressed Continuous Computation for Stochastic Optimal Control

- Library for solving stochastic optimal control problem with nonlinear dynamics
- Github source code: <https://github.com/goroda/c3sc>

PROFESSIONAL
MEMBERSHIPS

Society for Industrial and Applied Mathematics (SIAM), Member, 2010–present
 American Institute of Aeronautics and Astronautics (AIAA), Member, 2017–present
 Institute for Electrical and Electronics Engineers (IEEE), Member, 2018–present

PROFESSIONAL
SERVICE

Referee Service

- *ASME Turbine Technical Conference and Exposition*
- *American Control Conference (ACC)*
- *AIAA Scitech*
- *BIT Numerical Mathematics*
- *IEEE Transactions on Aerospace and Electronic Systems*
- *International Journal of Robotics Research (IJRR)*
- *Journal of Computational Physics*
- *Journal of Intelligent and Robotic Systems*

- *Mathematical Methods in the Applied Sciences*
- *Neural Computation*
- *Robotics: Science and Systems Conference (RSS)*
- *AIAA Journal on Aerospace Information Systems*
- *SIAM Journal of Scientific Computing*
- *SIAM Journal of Dynamical Systems*
- *SIAM Journal of Data Science*
- *SIAM/ASA Journal on Uncertainty Quantification*

CITIZENSHIP

USA