

Olga A. Doronina

Ph.D. Candidate

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Education

- Aug. 2020 **Ph.D. Mechanical Engineering**, University of Colorado, Boulder, CO, GPA 3.83.
(Expected) Dissertation title: *Turbulence Model Development Using Approximate Bayesian Computation*.
Advisor: Dr. Peter E. Hamlington
- Dec. 2019 **M.S. Mechanical Engineering**, University of Colorado, Boulder, CO, GPA 3.83.
- Jul. 2019 **Postgraduate studies**, Moscow Institute of Physics and Technology (MIPT, Phystech), Moscow, Russia.
Specialty 05.13.18: Mathematical Modeling, Numerical Methods, and Software Engineering.
Thesis: *Anisotropic mesh adaptation methods for computational fluid dynamics*. Advisor: Dr. Tatiana Kozubskaya
- Jul. 2014 **M.S. Applied Mathematics and Physics**, Moscow Institute of Physics and Technology (MIPT, Phystech), Moscow, Russia, GPA 3.92 with honors.
Thesis: *Numerical simulation of acoustic wave interaction with isolated vortices*. Advisor: Dr. Tatiana Kozubskaya
- Jun. 2012 **B.S. Applied Mathematics and Physics**, Moscow Institute of Physics and Technology (MIPT, Phystech), Moscow, Russia, GPA 3.80.
Admitted as winner in the Moscow region Mathematical Olympiad.
Thesis: *Numerical simulation of acoustic wave scattering by a vortex*. Advisor: Dr. Tatiana Kozubskaya

Fellowships

- Sep. 2013 **Special Academic Fellowship (MIPT)**, For academic achievement.
- Jan. 2013 **Special Academic Fellowship (MIPT)**, For sport achievements as a member of the MIPT swimming team.
- Sep. 2008 **Governor's Fellowship (Moscow region)**, Winner in the Moscow region Mathematical Olympiad.

Professional Experience

Research Experience

- Jan. 2017 – present **Graduate Research Assistant**, Turbulence and Energy Systems Laboratory (TESLa), University of Colorado, Boulder, CO.
- Developed a flexible Approximate Bayesian Computation with Markov Chain Monte Carlo (ABC-MCMC) tool for turbulence model calibration, which made parameter estimation more efficient and robust.
 - Demonstrated ABC-MCMC method application for subgrid scale turbulence model calibration and published code open source.
 - Compared different modifications of the ABC-MCMC algorithm on calibration of a nonequilibrium model in homogeneous turbulent flow.
 - Applied ABC-MCMC to the RANS Menter SST model calibration and improved agreement of numerical simulation with experiment.
- Sep. 2012 – Jul. 2016 **Graduate Research Assistant**, Computational Aeroacoustics Laboratory, Keldysh Institute of Applied Mathematics (KIAM RAS), Moscow, Russia.
- Implemented a moving mesh algorithm for unstructured meshes into in-house code architecture using C/C++ and MPI with OpenMP.
 - Designed adaptive computational meshes using Gmsh to increase efficiency of simulations.
 - Investigated the acoustic radiation dynamics of a Rankine vortex, finding that even small perturbations cause the vortex to radiate acoustics.
- Sep. 2011 – Aug. 2012 **Undergraduate Research Assistant**, Computational Aeroacoustics Laboratory, Keldysh Institute of Applied Mathematics (KIAM RAS), Moscow, Russia.
- Simulated acoustic waves scattering by isolated vortices using the linear Euler equations.
 - Verified the EBR-scheme behavior on sharp velocity gradients and compared its accuracy on unstructured and different types of structured meshes.
- Mar. 2011 – Jun. 2011 **Undergraduate Research Assistant**, Dorodnitsyn Computing Centre of RAS, Moscow, Russia.
- Built and visualized a geo-database combining large amounts of environmental data from national parks using PostGIS and ArcGIS.

Teaching Experience

- Aug. 2016 – **Teaching Assistant**, *Department of Mechanical Engineering*, University of Colorado, Boulder, CO.
- Dec. 2016
- Computational Methods MCEN 3030: Assisted students through programming assignments using Matlab.
 - Finite Element Analysis MCEN 4173/5173: Conducted laboratory sessions guiding students through tutorials in ABAQUS.
 - Held office hours to help students with homework and lab assignments.
 - Graded homework assignments and exams.
- Feb. 2015 – **Numerical Methods Instructor of Record**, *Department of Numerical Mathematics*, Moscow Institute of Physics and Technology, Dolgoprudny, Russia.
- Jun. 2016
- Prepared lesson plans and lectured three classes of approximately 16 students each.
 - Designed and evaluated practice programming assignments, homework, and exams.
- Sep. 2012 – **Private Tutor**, Moscow, Russia.
- Jun. 2016
- Tutored middle school, high school, and undergraduate students in calculus, linear algebra, probability, statistics, geometry, algebra, and physics.
- Sep. 2011 – **Grader**, *Correspondence School of Physics and Mathematics*, Moscow Institute of Physics and Technology, Dolgoprudny, Russia.
- Aug. 2013
- Graded problem sets and demonstrated solutions in high school math and physics.

Publications

Peer-Reviewed Journal Publications - Published

- [1] I. V. Abalakin, P. A. Bahvalov, **Doronina, O. A.**, N. S. Zhdanova, and T. K. Kozubskaya. “Simulating Aerodynamics of a Moving Body Specified by Immersed Boundaries on Dynamically Adaptive Unstructured Meshes”. In: *Mathematical Models and Computer Simulations* 11.1 (2019), pp. 35–45.
- [2] **Doronina, O. A.**, P. A. Bakhvalov, and T. K. Kozubskaya. “Numerical study of acoustic radiation dynamics of a Rankine vortex”. In: *Acoustical Physics* 62.4 (2016), pp. 467–477.
- [3] **Doronina, O. A.** and N. S. Zhdanova. “Numerical simulation of acoustic waves scattering by isolated vortex structures”. In: *Matematicheskoe Modelirovanie (in russian)* 25.9 (2013), pp. 85–94.

Peer-Reviewed Journal Publications - Submitted

- [4] **Doronina, Olga A.**, Colin A. Z. Towery, and Peter E. Hamlington. “Parameter Estimation for Subgrid-Scale Models Using Markov Chain Monte Carlo Approximate Bayesian Computation”. *Physical Review Fluids* (submitted). 2020.
- [5] Jason D. Christopher, **Doronina, Olga A.**, Daniel Petrykowski, Torrey R. S. Hayden, Caelan Lapointe, Nicholas T. Wimer, Ian Grooms, Gregory B. Rieker, and Peter E. Hamlington. “Flow Parameter Estimation Using Laser Absorption Spectroscopy and Approximate Bayesian Computation”. *Experiments in Fluids* (submitted). 2020.

Peer-Reviewed Journal Publications - In preparation

- [6] **Doronina, Olga A.**, Scott M. Murman, and Peter E. Hamlington. “Parameter Estimation for Menter SST RANS Model Using Markov Chain Monte Carlo Approximate Bayesian Computation”.
- [7] **Doronina, Olga A.** and Peter E. Hamlington. “Approximate Bayesian Computation for Parameter Estimation in RANS Turbulence Models”.

Conference proceedings - Published

- [8] **Doronina, Olga**, Jason Christopher, Colin Towery, Peter Hamlington, and Werner Dahm. “Autonomic Closure for Turbulent Flows Using Approximate Bayesian Computation”. In: *2018 AIAA Aerospace Sciences Meeting*. 2018, p. 0594.
- [9] **Doronina, Olga**, Colin A. Towery, Jason D. Christopher, Ian Grooms, and Peter E. Hamlington. “Turbulence Model Development Using Markov Chain Monte Carlo Approximate Bayesian Computation”. In: *AIAA Scitech 2019 Forum*. 2019, p. 1883.

Professional Service

Conference Organization

- 2017 **Volunteer**, *70th Annual Meeting of the APS Division of Fluid Dynamics*, November 19-21, Denver, CO.
- 2017 **Abstract sorting**, *70th Annual Meeting of the APS Division of Fluid Dynamics*, August, Boulder, CO.

- 2014 **Organizing committee**, *Third International Workshop "Computational Experiment in Aeroacoustics"*, September, Svetlogorsk, Russia.
- 2012 **Organizing committee**, *Second International Workshop "Computational Experiment in Aeroacoustics"*, September 19-22, Svetlogorsk, Russia.

Local Conference and Workshop Organization

- 2019 **Student Co-Organizer**, *5rd Annual Rocky Mountain Fluid Mechanics Research Symposium*, July 29, Boulder, CO.
- 2018 **Student Co-Organizer**, *4rd Annual Rocky Mountain Fluid Mechanics Research Symposium*, August 13-14, Boulder, CO.
- 2017 **Student Co-Organizer**, *3rd Annual Rocky Mountain Fluid Mechanics Research Symposium*, August 11, Boulder, CO.
- 2015 **Student Co-Organizer**, *CFD-weekend in Keldysh Institute of Applied Mathematics*, November 28-29, Moscow, Russia.
- 2014 **Student Co-Organizer**, *CFD-weekend in Keldysh Institute of Applied Mathematics*, October 25-26, Moscow, Russia.

Journal Reviews

- Applied Soft Computing Journal

Scientific Presentations at Conferences and Seminars

- Nov. 2019 Olga Doronina, Scott Murman, and Peter Hamlington, Approximate Bayesian Computation for parameter estimation in RANS turbulence models, *APS DFD*, Seattle, WA, US.
- Aug. 2019 Olga Doronina and Peter Hamlington. Turbulence model development using Approximate Bayesian Computation, *RMFM*, Boulder, CO, US.
- Jan. 2019 Olga A. Doronina, Colin A. Z. Towery, Jason D. Christopher, Ian Grooms, and Peter E. Hamlington. Turbulence model development using Markov chain Monte Carlo Approximate Bayesian Computation, *AIAA Scitech*, San Diego, CA, US.
- Dec. 2018 Olga Doronina. Turbulence model development using Approximate Bayesian Computation, *Seminar at Keldysh Institute of Applied Mathematics*, Moscow, Russia.
- Nov. 2018 Olga Doronina, Colin Towery, and Peter Hamlington. Subgrid-scale model development using Approximate Bayesian Computation, *APS DFD*, Atlanta, GA, US.
- Aug. 2018 Olga Doronina, Colin Towery, and Peter Hamlington. On Markov chain Monte Carlo Approximate Bayesian Computation approach for subgrid-scale model development, *RMFM*, Boulder, CO, US.
- Jan. 2018 Olga A. Doronina, Jason D. Christopher, Colin A. Z. Towery, Peter E. Hamlington, and Werner J. A. Dahm. Autonomic closure for turbulent flows using Approximate Bayesian Computation, *AIAA Scitech*, Orlando, FL, US.
- Nov. 2017 Olga Doronina, Jason Christopher, Colin Towery, Peter Hamlington, and Werner Dahm. Autonomic closure for turbulent flows using Approximate Bayesian Computation, *APS DFD*, Denver, CO, US.
- Aug. 2017 Olga Doronina and Peter Hamlington. Parameter estimation for eddy-viscosity model using Approximate Bayesian Computation, *RMFM*, Boulder, CO, US.
- Sep. 2016 I. Abalakin, P. Bahvalov, O. Doronina, N. Zhdanova and T. Kozubskaya, Modeling of aerodynamics of moving bodies using mesh adaptation to immersed boundaries on unstructured triangular meshes, *Workshop "Computational Experiment in Aeroacoustics"*, Svetlogorsk, Russia.
- Nov. 2015 Olga Doronina and Tatiana Kozubskaya, Numerical investigation of the Rankin vortex instability and the dynamics of its radiation, *58th annual MIPT scientific conference*, Dolgoprudny, Russia.
- Sep. 2015 Olga Doronina and Tatiana Kozubskaya, Numerical simulation of acoustic radiation by Rankin vortex, *Forth Open Russian National conference on aeroacoustics*, Zvenigorod, Russia.
- Nov. 2012 Olga Doronina and Tatiana Kozubskaya, Mathematical modeling of acoustic waves scattering on isolated vortex, *55th annual MIPT scientific conference*, Dolgoprudny, Russia.
- Sep. 2012 Olga Doronina and Tatiana Kozubskaya, Computational simulation of acoustic waves interaction with isolated vortex structure in a linear approximation, *Workshop "Computational Experiment in Aeroacoustics"*, Svetlogorsk, Russia.