

## CURRICULUM VITAE

ALEXANDER LABOVSKY

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### Employment

- Associate Professor, Michigan Technological University, 2016– present.
- Assistant Professor, Michigan Technological University, 2011–2016.
- PostDoctoral Scholar, Florida State University, 2009–2011.
- PostDoctoral Scholar, University of Missouri-Columbia, 2008–2009.

### Education

- Ph.D. in Mathematics, University of Pittsburgh, 2003-2008  
Advisor: Professor William J. Layton  
Ph.D. Thesis: Mathematical Architecture for Models of Fluid Flow Phenomena.
- B.S. in Computational Mathematics and Computer Science, Moscow State University, Moscow, Russia, 1997-2002.  
Advisor: Professor V.B. Andreev  
B.S. Thesis: "On a monotonicity of a four point scheme for singularly perturbed convection diffusion problem"

### Research Interests

#### Computational Fluid Dynamics and Applications

Navier-Stokes Equations  
Large Eddy Simulation of Turbulence  
Approximate deconvolution models of turbulence  
Multiscale Models and Computations

#### Coupled NS systems: MagnetoHydroDynamics

Phenomenology of MHD Turbulence  
Turbulent models for MHD

#### Numerical Methods for Partial Differential Equations

High Accuracy Discretization  
Multiscale Methods  
Finite Element Methods  
Spectral Methods

#### Stochastic Analysis of PDEs (Uncertainty Quantification)

Efficient numerical methods for stochastic PDEs

Stochastic PDEs in high dimensions: sparse grids, collocation

Dynamical Systems approach to Turbulence

Markov Chain approximations of chaos in ODE systems

Segment Description of Turbulence

Coherent structures in fluid flow

Elucidation and Sensitivity

### Publications / Preprints

1. A. Labovsky, *A Defect Correction Method for the Time-Dependent Navier-Stokes Equations*, Numerical Methods for Partial Differential Equations, vol.25(1), pp.1-25, 2008.
2. A. Labovsky, *A Defect Correction Method for the Evolutionary Convection Diffusion Problem with Increased Time Accuracy*, Computational Methods in Applied Mathematics, vol.9(2), pp.154-164, 2009.
3. N. Heitmann, A. Labovsky, *Numerical Analysis of a Method for High Peclet Number Transport in Porous Media*, Journal of Mathematical Analysis and Applications, vol.351(2), pp.721-733, 2009.
4. A. Labovsky, W. Layton, C. Manica, M. Neda, L. Rebholz, *The Stabilized, Extrapolated Trapezoidal Finite Element Method for the Navier-Stokes Equations*, Computer Methods in Applied Mechanics and Engineering, vol.198(9-12), pp.958-974, 2009.
5. J. Connors, A. Labovsky, *Semi-Implicit Spectral Deferred Correction Methods for a Parabolic Two-Domain Problem*, Technical report, 2009.
6. A. Labovsky, Y. Charles Li, *A Markov Chain Approximation of a Segment Description of Chaos*, Dynamics of Partial Differential Equations, vol.7, pp.65-76, 2010.
7. M. Case, A. Labovsky, L. Rebholz, N. Wilson, *A high physical accuracy method for incompressible magnetohydrodynamics*, International Journal Numerical Analysis and Modeling, Series B, vol. 0 (2), pp. 219-238, 2010.
8. A. Labovsky, C. Trenchea, *A family of Approximate Deconvolution Models for MagnetoHydroDynamic Turbulence*, Numerical Functional Analysis and Optimization, vol.31(12), pp.1362-1385, 2010.
9. M. Gunzburger, A. Labovsky, *Effects of Approximate Deconvolution Models on the Solution of the Stochastic Navier-Stokes Equations*, Journal of Computational Mathematics, vol. 29, pp. 131-140, 2011.
10. A. Labovsky, C. Trenchea, *Large Eddy Simulation for Turbulent Magnetohydrodynamic Flows*, Journal of Mathematical Analysis and Applications, 377 (2011), pp.516-533.
11. M. Gunzburger, A. Labovsky, *High Accuracy Method for Turbulent Flow Problems*, M3AS: Mathematical Models and Methods in Applied Sciences, vol. 22 (6), 2012, DOI: 10.1142/S0218202512500054.
12. M. Gunzburger, A. Labovsky, *An Efficient and Accurate Method for the Identification of the Most Influential Random Parameters Appearing in the Input Data for PDEs*, SIAM/ASA J. Uncertainty Quantification, vol 2(1), 82105, 2014.
13. A. Labovsky, *A defect correction approach to turbulence modeling*, Numerical Methods for Partial Differential Equations, vol 31(1), pp. 268-288, 2015.
14. A. Labovsky, C. Trenchea, N. Wilson, *High Accuracy Method for Magnetohydrodynamics System in Elsasser Variables*, Computational Methods in Applied

Mathematics, vol 15(1), pp. 97-110, 2015

15. A. Labovsky, W. Layton, *Magnetohydrodynamic Flows: Boussinesq Conjecture*, JMAA, vol 434(2), pp. 1665-1675, 2016.

16. M. Aggul, A. Labovsky, *A High Accuracy Minimally Invasive Regularization Technique for Navier-Stokes Equations at High Reynolds Number*, Numerical Methods for Partial Differential Equations, 2016, DOI: 10.1002/num.22124.

17. D. Erkmén, A. Labovsky, *Defect-deferred correction method for the two-domain convection-diffusion problem*, JMAA, 2017, DOI: 10.1016/j.jmaa.2017.01.018.

18. M. Aggul, J. Connors, D. Erkmén, A. Labovsky, *A Defect-Deferred Correction Method for Fluid-Fluid Interaction*, SIAM J. Numer. Anal., 56(4), pp. 2484 - 2512, 2018.

19. D. Erkmén, A. Labovsky, *Note On the Usage of Grad-Div Stabilization for the Penalty-Projection Algorithm in Magnetohydrodynamics*, Applied Mathematics with Computation, Under Review, 2018.

20. M. Aggul, S. Kaya, A. Labovsky, *Two approaches to creating a turbulence model with increased temporal accuracy*, Applied Mathematics with Computation, Under Review, 2018.

### Conference Proceedings

21. A. Labovsky, W. Layton, C. Manica, M. Neda, L. Rebholz, I. Stanculescu, C. Trenchea, *Mathematical Architecture of Approximate Deconvolution Models of Turbulence*, invited presentation at Quality and Reliability of Large-Eddy Simulations 2007. (published by Springer as part of the ERCOFTAC Series, with book title "Quality and Reliability of Large-Eddy Simulations.")

### Work in Preparation

22. M. Aggul, A. Labovsky, *A high accuracy turbulence model for the atmosphere-ocean coupling problem*.

23. D. Erkmén, A. Labovsky, *Optimizing the "look-ahead" A-stable methods*.

### Conference Talks and Seminars

1. "High Accuracy Partitioned Method for Fluid-Fluid Interaction", Joint Mathematics Meeting, San Diego, CA, 2018.

2. "Resolving fluid-fluid interaction problems with high accuracy, using legacy codes", Kliakhandler Conference 2016, MTU, August 2016.

3. "Boussinesq assumption for Magnetohydrodynamics", ASCAM, Las Vegas, NV, October 2015.

4. "Defect Correction Method for Magnetohydrodynamic Flows", AMS Southeastern Sectional Meeting, Huntsville, March 2015.

5. "Boussinesq Conjecture for Magnetohydrodynamic Flows", AMS Central Sectional Meeting, East Lansing, MI, March 2015.

6. "Boussinesq Conjecture for Magnetohydrodynamic Flows", Applied Math Seminar, MTU, 2014.

7. "Can a Defect Correction Method be viewed as a Turbulence Model?", SIAM Annual Meeting, San Diego, 2013

8. "Can a Defect Correction Method be viewed as a Turbulence Model?", SIAM-SEAS, Knoxville, 2013

9. "Can a Defect Correction Method be viewed as a Turbulence Model?", Applied Math Seminar, MTU, 2012

10. "A method for the identification of the most influential random input parameters in PDEs in application to MagnetoHydroDynamics", Applied Math Seminar, MTU, 2012
11. "A method for the identification of the most influential random input parameters in PDEs in application to MagnetoHydroDynamics", SIAM annual meeting, Minneapolis, 2012
12. "Efficient numerical method for PDEs with random input data", 8-th International Conference on Scientific Computing and Applications, Las Vegas, 2012
13. "Efficient numerical method for PDEs with random input data", University of Pittsburgh, March 2012
14. "Approximate Deconvolution Models of Turbulence", series of talks, Applied Math Seminar, MTU, 2011
15. "Efficient numerical method for stochastic partial differential equations in application to MagnetoHydroDynamics", SIAM-SEAS, Charlotte, NC, 2011
16. "Models of fluid flow: turbulence and uncertainty quantification", Sandia National Laboratories, February 2011.
17. "Turbulence Modeling for Stochastic Navier-Stokes Equations", SIAM-2010, Pittsburgh, July 2010.
18. "Effects of Approximate Deconvolution Models on the Solution of the Stochastic Navier-Stokes Equations", Conference on Uncertainty Quantification, Edinburgh, Scotland, May 2010.
19. "Turbulence Modeling; Approximate Deconvolution Models." invited talk, Clemson University, April 2010.
20. "Turbulence Modeling in MagnetoHydrodynamics and in Stochastic NSE", Graduate Student Seminar, Florida State University, March 2010.
21. "A Deferred Correction Method for a Decoupled Fluid-Fluid Interaction", Computational Mathematics Seminar, Florida State University, February 2010.
22. "A Markov Chain Approximation of a Segment Description of Chaos", Computational Mathematics Seminar, Florida State University, February 2010.
23. "High accuracy partitioned timestepping methods for a two domain problem", AMS sectional meeting, Florida Atlantic University, October 2009.
24. "Modeling of Stochastic Turbulent Navier-Stokes Equations", Computational Mathematics Seminar, Florida State University, October 2009.
25. "High accuracy Methods for PDEs. Turbulent models for MagnetoHydrodynamics", Computational Mathematics Seminar, Florida State University, October 2009.
26. "High accuracy numerical methods for fluid flow problems and turbulence modeling", invited talk at the Duke University, April 2009.
27. "Semi-implicit spectral deferred correction methods for a parabolic two domain problem", AMS sectional meeting, NC State University, April 2009.
28. "Approximate Deconvolution Models for MagnetoHydroDynamic Turbulence", AMS sectional meeting, NC State University, April 2009.
29. "Finite element methods. FreeFEM - environment for high-level programming", Numerical Analysis Seminar, University of Missouri-Columbia, April 2009 (coming up).
30. "High accuracy methods for a parabolic two domain problem. Semi-implicit spectral deferred correction methods", Numerical Analysis Seminar, University of Missouri-Columbia, February 2009.

31. "Mathematical Architecture for Models of Fluid Flow Phenomena", Iowa State University, February 2009.

32. "High Accuracy Numerical Methods for PDEs. Turbulence Models in MagnetoHydroDynamics", Differential Equations Seminar, University of Missouri-Columbia, September 2008.

33. "Mathematical Architecture for Models of Fluid Flow Phenomena", University of New Hampshire, February 2008.

34. "LES model of MHD equations. Conservation Laws", Computational Mathematics Seminar, University of Pittsburgh, March 2007.

35. "Defect correction method for the time-dependent Navier-Stokes equations", talk at the Finite Element Circus, Penn State University, Fall 2006.

36. "A Defect Correction Method for Evolutionary PDEs", Computational Mathematics Seminar, University of Pittsburgh, Spring 2006.

### **Awards**

- Diploma cum laude from Moscow State University, 2002
- Culver-Teplitz prize in recognition of outstanding teaching and research performance, University of Pittsburgh, 2007.
- Outstanding Teaching Award, Michigan Technological University, 2014.

### **Computing skills**

- Languages: C++, C, Fortran;
- Applications: Matlab, Maple;
- Software: FreeFEM++

### **Service**

- Co-organizer of Applied Math Seminar, MTU, Fall 2011
- Recruitment Committee member, 2011-2012.
- Organizer of Applied Math Seminar, MTU, Fall 2012
- Co-organizer of a three-part minisymposium "Recent Advances in Analysis and Numerical Methods for Fluid Flow Simulation" at the SIAM annual meeting in Minneapolis, 2012.
- Co-organizer of a two-part minisymposium "Advances in Modeling and Numerical Methods for Fluid Flow Problems" at the SIAM-SEAS meeting in Knoxville, 2013.
- PhD Thesis Committee member, summer 2013, for Abdallah Al-Habahbeh, graduating from the Department of Mathematical Sciences, MTU.
- Recruitment Committee member, 2013-2014.
- Graduate Committee member, 2013-2014.
- PhD Thesis Committee member, summer 2016, for Mohsen Jamalabdollahi, graduating from the Department of Electrical and Computer Engineering, MTU.
- PhD Thesis Committee member, December 2016, for Olabanji Shonibare, graduating from the Department of Mathematical Sciences, MTU.
- Co-organizer of a mini symposium in honor of William Layton's 60th birthday, AMS, Denver, CO, October 2016.

### **Teaching (Universities of Pittsburgh, Missouri, and Michigan Tech)**

- Year 2017-2018 (MTU) - Instructor for Calc I (course coordinator) and ODEs (graduate level).
- Year 2016-2017 (MTU) - Instructor for Calc I (course coordinator) and Study of Incompressible Flows (topics course, graduate level).
- Year 2015-2016 (MTU) - Instructor for Calc II, Numerical PDEs (graduate level), PDEs (graduate level).
- Year 2014-2015 (MTU) - Instructor for Calc II, Numerical ODEs (graduate level) and Study of Incompressible Flows (created the topics course, graduate level).
- Year 2013-2014 (MTU) - Instructor for Scientific Computing, Calc II and Numerical Linear Algebra (graduate level).
- Year 2012-2013 (MTU) - Instructor for Scientific Computing (created the course; undergraduate level), Calc II and Numerical ODEs (graduate level).
- Year 2011-2012 (MTU) - Instructor for Calc I and Calc II.
- Year 2008-2009 (University of Missouri-Columbia) - Instructor for Calc III.
- Fall 07: (TA) Matrices and Linear Operators, (grader) Numerical methods for PDE - graduate courses;
- Spring 07: (TA) Calculus I,
- Fall 06 : (Instructor) Calculus II,
- Summer 06 : (Instructor) Calculus II,
- Spring 06: (TA) Calculus I,
- Fall 05 : (TA and grader) Calculus II, Linear Algebra - graduate course,
- Summer 05 : (Instructor) Calculus I, Calculus II,
- Spring 05: (TA) Calculus I,
- Fall 04 : (TA) Calculus I,
- Summer 04 : (TA) PreCalculus, Business Calculus,
- Spring 04: (TA) PreCalculus.

### References

- Prof. William J. Layton, Department of Mathematics, University of Pittsburgh, phone: (412) 624-8375, e-mail: wjl@pitt.edu
- Prof. Max Gunzburger, Frances Eppes Eminent Professor and Chair, Department of Scientific Computing, Florida State University, phone: (850) 644-7060, e-mail: gunzburg@fsu.edu
- Prof. Catalin Trenchea, Department of Mathematics, University of Pittsburgh, phone: (412) 624-5681, e-mail: trenchea@pitt.edu
- Prof. M. Sussman, Department of Mathematics, University of Pittsburgh, phone: (412) 624-1273, e-mail: sussmanm@math.pitt.edu
- Prof. C. Chicone, Department of Mathematics, Univ. of Missouri, Columbia, phone: (573) 882-6331, e-mail: chiconec@missouri.edu

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