

DENIS ASLANGIL, Ph.D.

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Research Interest:

Data-driven spatiotemporal modeling, physics informed machine learning, multi-material mixing, supersonic combustion, hydrodynamic instabilities, internal gravity waves, turbulence theory, direct numerical and large-eddy simulations, high performance computing, computational fluid dynamics.

Education:

Ph.D. in Mechanical Engineering August 2019
Lehigh University, Bethlehem, PA
Dissertation: Dynamics of Buoyancy-Driven Variable-Density Non-Boussinesq Turbulence
Advisor: Prof. Arindam Banerjee, **co-advisor:** Dr. Daniel Livescu

M.Sc. in Mechanical Engineering August 2015
Lehigh University, Bethlehem, PA
Thesis: Exploring Initial Condition Effects on Variable Acceleration Rayleigh Taylor Instability using Implicit Large Eddy Simulations
Advisor: Prof. Arindam Banerjee

B.Sc. in Mechanical Engineering and Industrial Engineering (double major) 2012
Istanbul Technical University, Istanbul, Turkey

Work Experience:

Los Alamos National Laboratory Los Alamos, NM
Post-doctoral fellow 2019 – Current

- Improved graphical model to learn turbulence large- and small-scale behaviors
- Advanced the state of turbulence modeling by providing viable approaches to capture variable-density effects
- Explored new physical insights in turbulence applications by using physics informed machine learning
- Extended classical incompressible turbulence theory to variable-density turbulence
- Parallel computing, high-performance computers, big data analytics, direct numerical simulations, programming in Fortran, Python, and Julia

Los Alamos National Laboratory Los Alamos, NM
Graduate Student Research Assistant 2015 – 2019

- Summer Internship during Ph.D. studies at Lehigh University

Lehigh University Bethlehem, PA
Graduate Research Assistant 2012 – 2019

Ph.D. Dissertation (2015-2019):

- Identified the similarities and differences between the buoyancy-driven variable-density turbulence and the more conventional stationary turbulence
- Studied non-Boussinesq and high Reynolds number effects on variable-density turbulence
- Extended classical incompressible turbulence theory to variable-density turbulence
- Parallel computing, high-performance computers, big data analytics, direct numerical simulations, programming in Fortran

M.Sc. Thesis (2012-2015):

- Studied the effect of initial conditions on late-time evolution to turbulence of Rayleigh Taylor Instability under variable acceleration histories
- Parallel computing, big data analytics, implicit large-eddy simulations, programming in C++

Arcelik AS

Istanbul, Turkey

Assistant Engineer in Research and Development

2010

- Worked in "Quadro Pump Design Project" to design a volute and impeller for a dishwasher 'machine's discharge pump as a summer intern.

Istanbul Technical University

Istanbul, Turkey

Teaching Assistant

2009 – 2011

- Guided and supervised undergraduate students for using Solid Works and AutoCAD in their laboratory sessions and projects in Computer Aided Technical Drawing course.

Şişli Sport Club

Istanbul, Turkey

Licensed Chess Player

2007 – 2012

- Played in the Chess Team of Şişli Sports Club in Turkish Chess Federation League.

Advising:

- 1) Aren Boyaci (Ph.D. ME – Lehigh University): Forecasting Rayleigh-Taylor instability growth between solid-fluid interface using machine learning
- 2) Elif Ecem Bas (Ph.D. CE – University of Nevada, Reno): Predicting non-linear behavior of the structural braces using machine learning

Research funding and Grants:

- 1) Denis Aslangil (PI) and Man Long Wong, "*Compressibility effects in two-dimensional Rayleigh-Taylor Instability*", US NSF - XSEDE Startup allocation.
- 2) Daniel Livescu, Arindam Banerjee and Denis Aslangil, "*Non-Boussinesq effects on buoyancy-driven variable-density turbulence*", Argonne Leadership Computing Facility Award, 60 Million processor hours.
- 3) Daniel Livescu and Denis Aslangil, "*Variable-density turbulence*", Institutional Computing Program at Los Alamos National Laboratory Award, 15 Million processor hours.
- 4) Daniel Livescu and Denis Aslangil, "*Variable-density under variable acceleration histories*" Institutional Computing Program at Los Alamos National Laboratory Award, 8 Million processor hours.

Awards and Honors:

- 5) Selected for participating in the Argonne Training Program on Extreme-Scale Computing, ATPESC 2020 in Chicago IL, which is a part of the Exascale Computing Project, and a collaborative effort of the DOE Office of Science and the National Nuclear Security Administration.
- 6) Awarded the first prize in the *best theoretical approach* category at the 2019 ASME IMECE U.S. National Science Foundation student poster competition (Awarded among 178 poster presentations).
- 7) Awarded Non-Academic Research Internships for Graduate Students Supplemental Funding, 2018 by U.S. National Science Foundation.
- 8) University Scholarship of Lehigh University, the Department of Mechanical Engineering and Mechanics, 2012-2013 (Awarded to the top student of the incoming graduate class of over 50 graduate students).
- 9) Graduated with double major in Mechanical Engineering and Industrial Engineering concurrently in four years, 2012.
- 10) Secured an overall rank of 3 out of 300 in Mechanical Engineering Department, Istanbul Technical University, 2012.

- 11) Secured High Honor List in Mechanical Engineering Department, Istanbul Technical University, from 2008 to 2012.
 - 12) Secured the 3rd place in Istanbul Chess Championship, 2003 and 2007.
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Published Journal Papers/Book Chapters (Peer reviewed)

- 1) **Denis Aslangil**, Daniel Livescu and Arindam Banerjee, *"Effects of Atwood and Reynolds numbers on the evolution of buoyancy-driven homogeneous variable-density turbulence"*, J. Fluid Mech. **895**, A12 (2020).
- 2) **Denis Aslangil**, Zachary Farley, Arindam Banerjee and Andrew Lawrie *Rayleigh-Taylor Instability with varying periods of zero acceleration* (in press) J. Fluids Engineering, **142** (12) (2020).
- 3) **Denis Aslangil**, Daniel Livescu and Arindam Banerjee, *"Acceleration reversal effects on buoyancy-driven variable-density turbulence"*, Proceedings of 22nd Australasian Fluid Mechanics Conference AFMC2020, Brisbane, Australia, 7-10 December, Published by The University of Queensland, Editors H. Chanson and R. Brown, Paper 125, (DOI: 10.14264/a55b8c2) (ISBN 978-1-74272-341-9).
- 4) Elif Ecem Bas, **Denis Aslangil** and M. Ali Moustafa, *"Predicting the non-linear seismic response of structural braces using machine learning"* (accepted, in press) ASME International Mechanical Engineering Congress and Exposition, (2020).
- 5) **Denis Aslangil**, Daniel Livescu and Arindam Banerjee, *"Buoyancy-driven homogeneous variable-density turbulence with asymmetric initial density distributions"*, Physica D: Nonlinear Phenomena **406**, 132444 (2020).
- 6) **Denis Aslangil**, Daniel Livescu and Arindam Banerjee, *"Flow regimes in buoyancy-driven variable-density turbulence"*, in: Örlü R., Talamelli A., Peinke J., Oberlack M. (eds) Progress in Turbulence VIII. iTi 2018. Springer Proceedings in Physics, vol 226. Springer, Cham.
- 7) Nairita Pal, Susan Kurien, Timothy Clark, **Denis Aslangil** and Daniel Livescu, *"Two-point spectral model for variable-density homogeneous turbulence"* Phys. Rev. Fluids **3**, 124608 (2018).
- 8) **Denis Aslangil**, Arindam Banerjee, and Andrew Lawrie *"Numerical investigation of initial condition effects on Rayleigh Taylor instability with acceleration reversals"* Phys. Rev. E **94**, 053114 (2016).

Manuscripts under review

- 9) **Denis Aslangil**, Daniel Livescu and Arindam Banerjee, *"Non-Boussinesq effects on buoyancy-driven variable-density turbulence"*, (under review) Journal of Fluid Mechanics (2020).
- 10) **Denis Aslangil***, Zachary Farley*, Arindam Banerjee and Andrew Lawrie *"On the effects of variable deceleration periods on Rayleigh-Taylor Instability with acceleration reversals"* (under review) Phys. of Fluids (2020). *Both authors contributed equally to this manuscript.
- 11) Juan A. Saenz, **Denis Aslangil** and Daniel Livescu, *"Filtering, averaging and scale dependency in homogeneous variable-density turbulence"*, (under review) Phys. of Fluids (2020).

Conference Abstracts and Invited Talks (only the first author talks are listed below)

- 12) **Denis Aslangil**, Daniel Livescu and Arindam Banerjee, Q08:10, *"Buoyancy-driven homogeneous turbulence with large density fluctuations"*, American Physical Society - Division of Fluid Dynamics, Chicago (virtual), IL (November 2020).
- 13) **Denis Aslangil**, Juan A. Saenz and Daniel Livescu, L04.00005, *"Filter-width and Atwood number effects in filtered homogeneous variable density turbulence"*, American Physical Society - Division of Fluid Dynamics, Seattle, WA (November 2019).
- 14) **Denis Aslangil**, Daniel Livescu and Arindam Banerjee, M01.00040, *"Homogeneous variable-density turbulence with asymmetric initial density distributions"*, American Physical Society - Division of Fluid Dynamics, Seattle, WA (November 2019).
- 15) **Denis Aslangil**, Daniel Livescu and Arindam Banerjee, *"Non-Boussinesq effects on buoyancy-driven variable-density turbulence"*, Arizona and Los Alamos Days, Tucson, AZ (April 2019).

- 16) **Denis Aslangil**, Zachary K. Farley, Arindam Banerjee, Andrew G. W. Lawrie, G28.00003, "*On the effects of variable deceleration periods on Rayleigh-Taylor instability with multiple acceleration reversals*", American Physical Society - Division of Fluid Dynamics, Atlanta, GA (November 2018).
- 17) **Denis Aslangil**, Daniel Livescu and Arindam Banerjee, "*Atwood and Reynolds numbers effects on the evolution of buoyancy-driven homogeneous variable-density turbulence*", Los Alamos National Laboratory Invited talk, COMUEX Talks, Los Alamos, NM (September 2018).
- 18) **Denis Aslangil**, Daniel Livescu and Arindam Banerjee, "*Variable-density effects on turbulent mixing*", International Workshop on the Physics at Compressible Turbulent Mixing 2018, Marseille, France.
- 19) **Denis Aslangil**, Daniel Livescu and Arindam Banerjee, M29.00008, "*Density-ratio effects on buoyancy-driven variable-density turbulent mixing*", American Physical Society - Division of Fluid Dynamics, Denver, CO (November 2017).
- 20) **Denis Aslangil**, Daniel Livescu and Arindam Banerjee, "*High-Atwood number effects on buoyancy-driven variable density homogeneous turbulence*", European Turbulence Conference, Stockholm, Sweden (August 2017).
- 21) **Denis Aslangil**, Daniel Livescu and Arindam Banerjee, M34.00006, "*Non-Boussinesq effects on buoyancy-driven variable-density turbulence*", American Physical Society - Division of Fluid Dynamics Portland, OR (November 2016).
- 22) **Denis Aslangil**, Daniel Livescu and Arindam Banerjee, D40.00003, "*Reynolds and Atwood Numbers Effects on Homogeneous Rayleigh Taylor Instability*", American Physical Society - Division of Fluid Dynamics, Boston, MA (November 2015).
- 23) **Denis Aslangil**, Daniel Livescu and Arindam Banerjee "*Variable density mixing under variable mean pressure gradient acceleration histories*", European Turbulence Conference, Delft, Netherlands (August 2015).
- 24) **Denis Aslangil**, Andrew Lawrie and Arindam Banerjee, A22.00006, "*Rayleigh Taylor Instability with Acceleration Reversals*" American Physical Society - Division of Fluid Dynamics, San Francisco, CA (November 2014).
- 25) **Denis Aslangil**, Andrew Lawrie and Arindam Banerjee "*Effect of initial conditions on late-time evolution to turbulence of Rayleigh Taylor instability under variable acceleration histories*", International Workshop on the Physics at Compressible Turbulent Mixing, San Francisco, CA (August 2014).
- 26) **Denis Aslangil**, Andrew Lawrie and Arindam Banerjee "*Effect of initial conditions on late-time evolution to turbulence of Rayleigh Taylor instability under variable acceleration histories*", Int. Centre for Theoretical Physics-Turbulent Mixing and Beyond Workshop, Trieste, Italy (August 2014).
- 27) **Denis Aslangil**, Andrew Lawrie and Arindam Banerjee, L30.00006, "*Initial condition effects on turbulent Rayleigh Taylor instability under variable acceleration history.*", American Physical Society - Division of Fluid Dynamics, Pittsburgh, PA (November 2013).

Conferences Organized:

- Reviewer, American Institute of Aeronautics and Astronautics, AVIATION Forum, June, 2021.
- Session chair, American Institute of Aeronautics and Astronautics, SciTech Forum, January, 2021.
- Topic co-organizer, Fluids Engineering Division Summer Meeting 2020, Orlando, FL, July 2020.
- Session organizer, International Mechanical Engineering Congress & Exposition (ASME IMECE 2020), Portland, OR, November 2020.

Journals Reviewed:

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| <ul style="list-style-type: none"> • <i>Physical Review Fluids</i> • <i>ASME J. of Fluids Engineering</i> • <i>Physical Review E</i> • <i>Physics of Fluids</i> | <ul style="list-style-type: none"> • <i>Physica D: Nonlinear Phenomena</i> • <i>International J. of Multi-phase Flow</i> • <i>Renewable Energy</i> |
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Professional Affiliations:

- American Society of Mechanical Engineering (ASME)
 - American Physical Society (APS)
 - American Institute of Aeronautics and Astronautics (AIAA)
 - American Geophysical Union (AGU)
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Acquired Skills

- Operating Systems: Windows, Unix based OS
 - Computer Languages: Python, Pytorch, C, C++, Fortran, Matlab, Julia
 - Softwares: ParaView, Solid Works, AutoCAD, Tecplot, Grace, Sigma Plot.
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