DENIS ASLANGIL

Assistant Professor, Department of Mechanical Engineering, Colorado School of Miness

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Research Expertise:

i. multi-material/phase, reactive/non-reactive turbulent mixing and hydrodynamic instabilities,
ii. fluid-structure interactions and aeroacoustics in subsonic, supersonic, and hypersonic applications,
iii. intelligent modeling to accelerate high-fidelity (DNS & LES) simulations,
i**v.** quantum computational fluid dynamics.

Academic Preparation:

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 (LANL)

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, **co-advisor:** Prof. Andrew Lawrie

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

Work Experience:

Colorado School of Mines Golden, CO
Assistant Prof. The Department of Mechanical Engineering **08/2024 – present**

The University of Alabama Tuscaloosa, AL
Assistant Prof. The Department of Aerospace Eng. and Mechanics **08/2021 – 07/2024**

Los Alamos National Laboratory (LANL) Los Alamos, NM
Post-doctoral fellow **2019 – 08/2021**

Los Alamos National Laboratory (LANL) Los Alamos, NM
Graduate Student Research Assistant **2015 – 2019**

Lehigh University Bethlehem, PA
Graduate Research Assistant **2012 – 2019**

Scholarly Contributions:

Published Journal Papers (Peer Reviewed)

1) **Denis Aslangil** and Man Long Wong, *"Investigation of strong isothermal stratification effects on multi-mode compressible Rayleigh–Taylor instability,"* Physics of Fluids **35** (8) (2023).

2) **Denis Aslangil**, Andrew Lawrie, and Arindam Banerjee, *"Effects of variable deceleration periods on Rayleigh-Taylor instability with acceleration reversals,"* Phys. Rev. E **105**, 065103 (2022).
3) Juan A. Saenz, **Denis Aslangil** and Daniel Livescu, *"Filtering, averaging and scale dependency in homogeneous variable-density turbulence,"* Phys. of Fluids, 33, 025115 (2021).
4) **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).
5) **Denis Aslangil**, Zachary Farley, Arindam Banerjee and Andrew Lawrie *Rayleigh-Taylor Instability with varying periods of zero acceleration,"* J. Fluids Engineering, **142** (12) (2020).
6) **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).
7) **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).
8) **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.
9) 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).
10) **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).
11) Yen Ting Lin, Robert B. Lowrie, **Denis Aslangil**, Yiğit Subaşı, and Andrew T. Sornborger *"Koopman von Neumann mechanics and the Koopman representation: A perspective on solving nonlinear dynamical systems with quantum computers,"* arXiv:2202.02188.

Published Conference Papers and Extended Abstracts

12) Orkun Ustun, **Denis Aslangil** and Man Long Wong, *"Numerical Simulations of Compressible Multi-layer Rayleigh–Taylor Instability,"* to be presented at AIAA SciTech Forum 2024.
13) Tyler Prine, **Denis Aslangil** and ManLong Wong, *"Study of iso-thermal stratification strength on 2D multi-mode compressible Rayleigh-Taylor instability,"* presented at AIAA SciTech Forum 2023.
14) **Denis Aslangil** and ManLong Wong, *"Study of iso-thermal stratification strength on 2D multi-mode compressible Rayleigh-Taylor instability,"* presented at AIAA SciTech Forum 2022.
15) ManLong Wong and **Denis Aslangil** *" Direct numerical simulations of 2D multi-mode compressible Rayleigh-Taylor instability to explore the effects of different iso-thermal stratification strengths,"* presented at 17th IWPCTM Atlanta GA, 2022.
16) Tyler Prine, **Denis Aslangil** and ManLong Wong *"Numerical investigation of compressibility and Atwood number effects on the single-mode iso-thermally stratified Rayleigh-Taylor Instability,"* presented at the 17th International Workshop on the Physics at Compressible Turbulent Mixing, Atlanta GA, 2022.
17) **Denis Aslangil**, Andrew Lawrie, and Arindam Banerjee *"Rayleigh-Taylor instability with variable acceleration reversal(s),"* presented at the 17th International Workshop on the Physics at Compressible Turbulent Mixing, Atlanta GA, 2022.
18) **Denis Aslangil**, Daniel Livescu, and Arindam Banerjee *" Different initial composition ratio effects on variable-density turbulent mixing,"* presented at the17th IWPCTM Atlanta GA, 2022.
19) Xingyu Su, Robin Walters, **Denis Aslangil**, Rose Yu, *"Forecasting variable-density 3D turbulent flow,"* accepted, to be presented at Simulation with Deep Learning (SimDL) International Conference on Learning Representations (ICLR) Workshop, 2021.
20) Elif Ecem Bas, **Denis Aslangil** and M. Ali Moustafa, *"Predicting the non-linear seismic response of structural braces using machine learning"* ASME International Mechanical Engineering Congress and Exposition, 2020.

21) **Denis Aslangil**, Daniel Livescu, Arindam Banerjee, *"Variable-density effects on turbulent mixing.,"* presented at the 16th International Workshop on the Physics at Compressible Turbulent Mixing, Marseille, France, 2018.
22) **Denis Aslangil**, Daniel Livescu, and Arindam Banerjee *"High-Atwood number effects on buoyancy-driven variable density homogeneous turbulence,"* presented at the 16th European Turbulence Conference, Stockholm, Sweden 2017.
23) **Denis Aslangil**, Daniel Livescu, and Arindam Banerjee *"High-Atwood number effects on buoyancy-driven variable density homogeneous turbulence,"* presented at the 15th European Turbulence Conference, Delft Netherlands, 2015.

Invited Talks

24) **Denis Aslangil** *"Variable-Density Turbulence: Theory, Simulations and Modeling,"* Department of Mechanical and Aerospace Engineering, the University of Virginia, Charlottesville VA, 2023
25) **Denis Aslangil** *"Turbulence with large composition and thermodynamic fluctuations,"* American University of Armenia, (virtual), 2023
26) **Denis Aslangil** *"Buoyancy-Driven Variable-Density Turbulence,"* Department of Mathematics, the University of Alabama, Tuscaloosa AL, 2022
27) **Denis Aslangil** *"Buoyancy-Driven Variable-Density Turbulence,"* Department of Aerospace Engineering and Mechanics, the University of Alabama, Tuscaloosa AL, 2021
28) **Denis Aslangil** *"Reynolds and Atwood number effects on the evolution of buoyancy-driven homogeneous variable density turbulence,"* Computational Physics and Methods, Los Alamos National Laboratory, Los Alamos, 2018.
29) **Denis Aslangil** *"Homogeneous variable-density turbulence,"* Arizona-Los Alamos Days, The University of Arizona, Tucson, AZ, 2018.

Conference Talks (first authors only)

30) **Denis Aslangil,** Man Long Wong, *"Statistics of 2D multi-mode iso-thermally stratified compressible Rayleigh-Taylor instability,"* American Physical Society - DFD, Indianapolis, IN (November 2022).
31) **Denis Aslangil**, Daniel Livescu, Arindam Banerjee, Q08:10, *"Buoyancy-driven homogeneous turbulence under sharp acceleration changes,"* American Physical Society - DFD, Phoenix, AZ (November 2021).
32) **Denis Aslangil,** *"Buoyancy-driven variable-density turbulence,"* ICCMAE 2022: The Second International Conference on Computational Methods and Applications in Engineering (May 2022).
33) **Denis Aslangil**, Daniel Livescu, Arindam Banerjee, Q08:10, *"Buoyancy-driven homogeneous turbulence with large density fluctuations,"* American Physical Society - Division of Fluid Dynamics, Chicago (virtual), IL (November 2020).
34) **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 - DFD, Seattle, WA (November 2019).
35) **Denis Aslangil**, Daniel Livescu, Arindam Banerjee, M01.00040, *"Homogeneous variable-density turbulence with asymmetric initial density distributions,"* American Physical Society - DFD, Seattle, WA (November 2019).
36) **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).
37) **Denis Aslangil**, Daniel Livescu, Arindam Banerjee, M29.00008, *"Density-ratio effects on buoyancy-driven variable-density turbulent mixing.,"* American Physical Society - DFD, Denver, CO (November 2017).
38) **Denis Aslangil**, Daniel Livescu, Arindam Banerjee, M34.00006, *"Non-Boussinesq effects on buoyancy-driven variable-density turbulence,"* American Physical Society – DFD, Portland, OR (November 2016).
39) **Denis Aslangil**, Daniel Livescu, Arindam Banerjee, D40.00003, *"Reynolds and Atwood Numbers Effects on Homogeneous Rayleigh Taylor Instability,"* American Physical Society - DFD, Boston, MA (November 2015).

40) **Denis Aslangil**, Andrew Lawrie, Arindam Banerjee, A22.00006, *"Rayleigh Taylor Instability with Acceleration Reversals"* American Physical Society - DFD, San Francisco, CA (November 2014).
41) **Denis Aslangil**, Andrew Lawrie, 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).
42) **Denis Aslangil**, Andrew Lawrie, Arindam Banerjee, L30.00006, *"Initial condition effects on turbulent Rayleigh Taylor instability under variable acceleration history.,"* American Physical Society - DFD, Pittsburgh, PA (November 2013).

Teaching:

MEGN 451: Fluid Mechanics II, (Fall 2024)

AEM 520: Advanced Computational Fluid Dynamics, (Spring 2024) Revised curriculum

AEM 606: Physical Gas Dynamics (Fall 2023) Revised curriculum

AEM 622: Turbulent Flows (Spring 2023) Revised curriculum

AEM 420: Computational Fluid Dynamics, Fall 2021, 2022, 2023

AEM 311: Fluid Mechanics (Aerospace, Mechanical, and Civil and Environmental Engineering sophomore students), Spring 2022

*Student reviews can be made available upon request.

Advising:

PhD Students:

- Ahmet Furkan Kula (ME, Mines) Developing high-fidelity high-order solver for compressible flows
- Orkun Ustun (ME, Mines) Compressible Rayleigh-Taylor Instability
- Paul Mekhedjian (AEM, UA) Optimizing of high-fidelity turbulence and plasma solvers on GPUs

MS Students:

- Hutson Staggs (AEM, UA) Compressible Rayleigh-Taylor instability
- Nick Pak (AEM, UA) Rayleigh-Taylor instability under variable acceleration histories

Undergraduate students:

- Aidan Gesch (AEM) Software development for GPU machines
- Sam Wood (CS) Physics-informed machine learning for turbulence data interpolation

Undergraduate Alumni:

- Benjamin Robertson (BS in AEM 2022) Analyzing homogeneous isotropic turbulence
- Tyler Prine (ME & AEM) Two-dimensional compressible Rayleigh-Taylor instability
- Gideon Lombardo (AEM) Multi-layer Rayleigh-Taylor instability
- Darren Ferrier (AEM) Designing autonomous morphing airfoils (computational)
- Ian Harlow (ME) Designing autonomous morphing airfoils (experimental)

Graduate Alumni:

- Brian Goldstein (AEM) Multi-species jet flows

- Laurin Thuney (AEM) Cooling strategies for hypersonic combustion
- Ronald Lee (AEM) Design of supersonic wind tunnel with variable Mach numbers
- Ahmet Furkan Kula (AEM) Immersed boundaries in compressible flow
- Orkun Ustun (AEM) Two-dimensional compressible mixing

Awards and Honors:

- The Southeastern Conference Universities (SEC) Faculty Travel Award (2023-24).
- Highlighted Alumni, Department of Mechanical Engineering & Mechanics, Lehigh University (2022).
- Travel award to attend ICCMAE 2022: The Second International Conference on Computational Methods and Applications in Engineering (2022).
- Outstanding Student Opinion of Instruction, given to the Department of Aerospace Engineering and Mechanics faculty member who has an average Student Opinion of Instruction score of 4.50/5.00 or greater (2021).
- 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.
- 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).
- Awarded Non-Academic Research Internships for Graduate Students Supplemental Funding, 2018 by U.S. National Science Foundation.
- 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).
- Graduated with double major in Mechanical Engineering and Industrial Engineering concurrently in four years, 2012.
- Secured an overall rank of 3 out of 300 in Mechanical Engineering Department, Istanbul Technical University, 2012.
- Secured High Honor List in Mechanical Engineering Department, Istanbul Technical University, from 2008 to 2012.
- Secured the 3rd place in Istanbul Chess Championship, 2003 and 2007.

Service:

<u>Conference organization and chairing:</u>

- Local Organization Committee member, International Workshop on Physics of Compressible Turbulent Mixing 2024, Bristol UK.
- Session chair, American Physical Society - Division of Fluid Dynamics, Washington DC, 11/2022.
- Session chair, American Physical Society - Division of Fluid Dynamics, Indianapolis, IN, 11/2022.
- 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.

<u>Outreach activities:</u>

- Invited talk at Northridge Middle School, Tuscaloosa AL, 2022.
- Scientific judge at Los Alamos National Laboratory Student Symposium, 2020.

- Invited lecturer on Fluid Dynamics at the Summer Physics Camp for Young Women at Los Alamos National Laboratory 2020.
- Scientific judge at Santa Fe Mathematics Days (High School students), 2018, 2019.
- Invited lecturer at Santa Fe Mathematics Days (High School students), 2018.

Journals reviewed:

Journal of Fluid Mechanics; Physical Review Fluids; Physical Review Letters; Physical Review E; Physics of Fluids; Renewable Energy; Physica D: Nonlinear Phenomena; ASME J. of Fluids Engineering; International J. of Multi-phase Flow

Panelist:

NSF CBET; NSF SBIR Program; Army Research Office

Professional Affiliations

- American Institute of Aeronautics and Astronautics (AIAA)
- American Society of Mechanical Engineering (ASME)
- American Physical Society (APS)
- American Chemical Society (ACS)
- American Geophysical Union (AGU)
- Australasian Fluid Mechanics Society (AFMS)