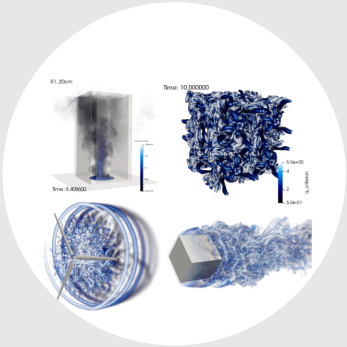


Stefan P. Domino Ph.D.

Computational Scientist

Sandia National Laboratories
1515 Eubank Blvd SE
Albuquerque, NM, 87123

https://github.com/NaluCFD

spdomin@sandia.gov
spdomin@stanford.edu
spdomino@comeri.org
spdomino@gmail.com

What I Do

I transform people's understanding of the world by deploying high-performing computational fluid dynamics tools. While some draw analogy to such computational tools as the rasp in Michelangelo's hand, I choose to view the partnership analogous to that of the luthier and the violinist in that both are required to make new that which was formerly unheard.

Skills/Attributes

- low-Mach Fluids*
- Turbulence
- Next-generation-platforms
- Software Development
- Outgoing
- Driven
- Passionate

(*)[Scale ranges from 0 (Fundamental Awareness) to 6 (Expert).]

Interests

My professional interest resides in the development and deployment of computational fluid dynamics (CFD) tools to facilitate a transformative understanding of otherwise intractable physical phenomena. By exercising these tools, in partnership with theory and experiments, a window into complex coupled processes can be illuminated. Studying low-Mach multi-physics applications that include turbulence, variable-density effects, buoyancy, multiphase, and chemical reactions often times reveals extraordinarily complex fluids, thermal, and species structures thereby allowing that which is generally unseen to be fully appreciated. Fostering partnerships within a diverse and high-performing team to solve grand-challenge problems provides me with ample motivation to work in the complex field of CFD.

Current Position(s) Held

Sandia	Computational Scientist; Engineering Science (1500).
Stanford	Adjunct Professor; School of Engineering, Institute for Computational and Mathematical Engineering (ICME), https://icme.stanford.edu.
COMERI	CEO/President/Senior Technical Scientist; https://comeri.org.

Education

1999 Doctor of Philosophy — Chemical Engineering, University of Utah
Researched and deployed advanced modeling and simulation techniques to more accurately predict the oxides of nitrogen (NO_x) in multiphase combustion applications. Advisor: Professor Philip Smith

1995 First Year Graduate Classes — Chemical Engineering, University of Washington
Researched atomic force microscopy applied to measuring DNA base pair hydrogen bonding. Advisor: Professor Buddy Ratner.

1994 Bachelor of Science — Chemical Engineering, University of Utah
Researched the use of per-fluorocarbons for advanced mammalian bioreactor design. Advisor: Professor Edward Trujillo.

Recent Peer-reviewed Publications

2021 Domino, S. P., Hewson, J., Knaus, R., Hansen, M., *Predicting large-scale pool fire dynamics using an unsteady flamelet- and large-eddy simulation-based model suite*, Phys. Fluids, https://doi.org/10.1063/5.0060267 (Editor's pick).

2021 Domino, S. P., *A case study on pathogen transport, deposition, evaporation and transmission: linking high-fidelity computational fluid dynamics simulations to probability of infection*, Int. J. CFD, https://doi.org/10.1080/10618562.2021.1905801.

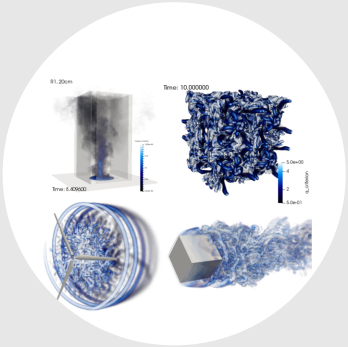
2021 Domino, S. P., Pierce, F., Hubbard, J., *A multi-physics computational investigation of droplet pathogen transport emanating from synthetic coughs and breathing*, Atom. Sprays, https://doi.org/10.1615/AtomizSpr.2021036313.

2019 Jofre, L., Domino, S. P., Iaacarino, G., *Eigensensitivity analysis of subgrid-scale stresses in large-eddy simulation of a turbulent axisymmetric jet*, Int. J. Heat Mass, https://doi.org/DOI:10.1016/J.IJHEATFLUIDFLOW.2019.04.014.

2019 Domino, S. P., Sakievich, P., Barone, M., *An assessment of atypical mesh topologies for low-Mach large-eddy simulation*, Comp. Fluids, https://doi.org/10.1016/j.compfluid.2018.12.002.

2018 Domino, S. P., *Design-order, non-conformal low-Mach fluid algorithms using a hybrid CVFEM/DG approach*, J. Comput. Phys., https://doi.org/10.1016/j.jcp.2018.01.007.

2018 Jofre, L., Domino, S. P., Iaacarino, G., *A framework for characterizing structural uncertainty in large-eddy simulation closures*, Flow Turb. Combust., https://doi.org/10.1007/s10494-017-9844-8.



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Goals

My primary career goal centers on extending state-of-the art in CFD methods to facilitate the advanced deployment of credible tools that support a wide range of atypical, e.g., fire, wind/wave-energy, computational ethology, etc., multi-physics applications. Mentoring, teaching, and motivating the next generation of computational scientists captures my core passion.

Investment Areas

Wave Energy*

Next-Generation Platforms

Ember Transport

Marine Ethology

VVUQ

Wildfires

Accidental Fires

(*)[Scale ranges from 0 (unfavorable) to 6 (favorable).]

Recent Experience

2005-now **Principal Member of the Technical Staff** — Sandia National Laboratories

My experience at Sandia rests within low-Mach turbulent fluid mechanics methods development for complex systems that drive the coupling of mass, momentum, species and energy transport. As PI, my research projects reside within the intersection of physics model development, numerical methods research, V&V techniques exploration, and high-performance computing and coding methods for low-Mach turbulent flow. I am the originator of the BSD open-source Nalu code base, https://github.com/NaluCFD. In my role as a technical staff, I am proud to have served the Lab's response to National crises such as Deep Water Horizon and the COVID-19 pandemic.

2020-now **Adjunct Professor** — Stanford/ICME

Co-teaching responsibilities for Stanford's ME469 Mechanical Engineering graduate CFD class where Nalu is used as pedagogical tool to bridge foundational numerical methods development and practical production CFD. I also support the mentoring of graduate students and post-doctoral candidates.

2018-now **CEO/President/Senior Technical Staff** — COMERI

Lead the management, research, and funding objectives for the Computational Marine Ethology Research Institute (COMERI) - a 501(c)(3) nonprofit research Institute that drives foundational understanding of marine ethology using first-principles physics.

2001-2005 **Senior Member of the Technical Staff** — Sandia National Laboratories

PI and lead developer for the generally unstructured, massively parallel Sierra/Fuego code base and team contributor to the NNSA Defense Programs Awards of Excellence for significant contributions Stockpile Stewardship Program.

2000-2001 **Postdoctoral appointee** — Sandia National Laboratories

Development of a smoke transport simulation tool for cargo bay fires in support of the FAA's response to ValueJet Flight 592. This work was recognized as part of the NASA Associate Administrator's Choice Award for Outstanding Accomplishment, (Glenn Research Center) and a R&D 100 Award for the development of a multi-parameter, micro-sensor-based low false alarm fire detection system.

Noteable Projects as PI

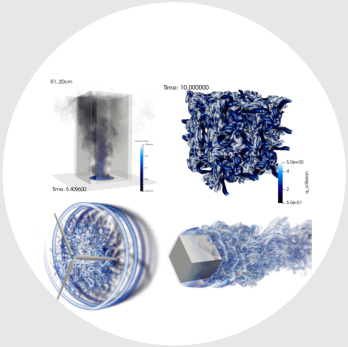
2019-now *Uncertainty quantification in crash-and-burn environments*. Exploring fire dynamics for accident scenarios that include varying pool shape and crosswind magnitude; developing structural uncertainties for large-eddy simulation through eigenvalue decomposition and perturbation of stresses towards limiting turbulence states.

2020-now *Agile Physics and Engineering Models*. Developing advanced coupling techniques for thermal response in the presence of thermal radiation; elucidation of non-isothermal jet impingement physics; wall-resolved large-eddy simulation modeling.

2021-now *Developing credible high-fidelity mod/sim tools for wave energy converter design*. Development of implicit overset methods coupled to six-DOF and volume of fluid transport.

2020-2021 *COVID-19 Transportation and Transmission*. High-fidelity pathogen modeling approaches for breathing and coughing events using an Eulerian/point-Lagrangian multi-physics paradigm that allows for the ability to distinguish between droplets that deposit and those that form persisting aerosol plumes.

2003 - 2006 *Sierra/Fuego Integrated Codes Project*. Fuego is the Sandia National Laboratories turbulent reacting flagship fire physics simulation tool that supports Science-based Stockpile Stewardship.



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Why I do it

The ability to explore multi-physics applications from a foundational modeling and simulation perspective is critical to future scientific advances. This high-level motivation has driven my desire to work within the intersection of physics elucidation, numerical methods development, and code development. More recently, the ability to deploy advanced uncertainty quantification (UQ) techniques to drive physics understanding, which may include structural uncertainty methods, machine learning approaches, etc., has transformed the former research paradigm.

Favorite Things

Replication of Past Work*

Family

Mountains

Snow

CFD

Pursuit of Knowledge

Science

Ocean

(*)[Scale ranges from 0 (unfavorable) to 6 (favorable).]

Noteworthy Publications/Book Chapters and Presentations

2017 Eldred, M., Ng, A., Barone, M., Domino, S. P., *Multifidelity uncertainty quantification using spectral stochastic discrepancy models*; In: Ghanem R., Higdon D., Owhadi H. (eds) Handbook of Uncertainty Quantification.

2014 Lin, P., Bettencourt, M., Domino, S. P., et al., *Towards extreme-scale simulations for low-Mach fluids with second-generation Trilinos*, Parallel Processing Letters, 24 (4).

2013 Domino, S. P., *A reflection of recent ASC milestones in support of the abnormal/thermal environment* Sandia National Laboratories Technical Report, SAND2013-3927P.

2009 Domino, S. P., *Computational approaches to multi-physics applicaitons: Predicting an object's thermal resposne within a turbulent reacting, participating media radiation enviornment.* Plenary Invitation, SIAM Conference on Computational Science and Engineering.

Distinguished Awards

2017 Sheldon R. Tieszen Sandia National Laboratories Engineering Sciences Award for a distinguished career in pursuit of technical excellence.

Noteworthy Experiences

2020 & 2021 Co-teaching Me469, Stanford Mechanical Engineering Departments Graduate Introduction to CFD class.

2006-2018 Six-time visiting scholar at Stanford's Center for Turbulence Research.

2000-now Numerous internal and external peer-reviews supported including journals, DOE panels, NSF, and others.

2000-now Mentoring of four post-doctoral researchers and five graduate students.

References

Please contact me for a comprehensive list of references.

Review

Dr. Stefan Domino is a computational domain specialist researcher who develops tools and techniques to support advancement of multi-physics understanding of complex phenomena including turbulent fluid mechanics, heat transfer, and chemical reactions.