

Stefan P. Domino

Computational Scientist



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<https://github.com/NaluCFD>



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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

low-Mach Fluids

Turbulence

NGP

Software Development

Outgoing

Driven

Passionate

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

Interests

My professional interest rests in the development and deployment of computational fluid dynamics tools, which can be used in a wide range of applications, to facilitate a transformative understanding of otherwise intractable physical phenomena. By using these tools, in partnership with theory and experiments, a window within complex coupled processes can be unsealed. Studying low-Mach multi-physics applications that include turbulence, variable density effects, buoyancy, 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 required to solve grand-challenge problems provides motivation to work in the complex field of CFD.

Education

1999

Doctor of Philosophy

Chemical Engineering, University of Utah

Research advanced modeling and simulation techniques in an effort to more accurately predict the oxides of Nitrogen (NOx) in pulverized coal furnaces

Peer-reviewed Publications

2019

An assessment of atypical mesh topologies for low-Mach large-eddy simulation; Domino, Sakievich, and Barone; Comput. & Fluids, 179 (30).

2018

Design-order, non-conformal low-Mach fluid algorithms using a hybrid CVFEM/DG approach; Domino; JCP, 359 (15).

2018

A framework for characterizing structural uncertainty in large-eddy simulation closures; Jofre, Domino, and Iaccarino; Flow Turb. & Comb., 100 (2).

2018

Uncertainty quantification in LES of channel flow; Safta, Blaylock, Templeton, Domino, and Najm; IJNMF., 83 (4).

2017

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

Awards

2017

Sheldon R. Tieszen Engineering Sciences Award for extensive technical excellence.

2000-2018

Several Sandia National Laboratories institutional achievement awards.

Experience

2005-now

Principal Member of the Technical Staff

Sandia National Laboratories

Principal Investigator of an ASC VVUQ project centered on assessing structural uncertainty for LES; originator of the open-source Nalu code base; member of the ExaWind team (Office of Science ECP, multi-laboratory, multi-institutional project) that is driving wind farm predictions on next generation platforms.

2001-2005

Senior Member of the Technical Staff

Sandia National Laboratories

Principal Investigator and lead developer for the generally unstructured, massively parallel Sierra low-Mach module Fuego code base. This fire mechanics simulation tool supports NNSA's mission of Science-based Stockpile Stewardship.

2000-2001

Postdoctoral appointee

Sandia National Laboratories

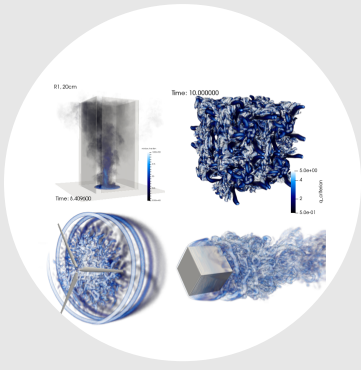
Development of smoke transport simulation tools for use in cargo bay fires.

1996-2000

Research Assistant

University of Utah

Graduate student within the chemical engineering department focused on computational approaches for improved NOx prediction.



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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 (not-so favorite) to 6 (no question).]

Goals

My primary career goals are to extend the state-of-the art in computational fluid dynamics to facilitate the advanced deployment and acceptance of this tool to support a wide and novel range of multi-physics applications. Mentoring, teaching, and motivating the next generation of computational scientists also represents a core passion.

Select Publications

- 2018 The suitability of hybrid meshes for low-Mach large-eddy simulation; Domino, Jofre, and Iaccarino; Proceedings of the 2018 Center for Turbulence Research Summer Program; Stanford University.
- 2018 Characterization of structural uncertainty in large-eddy simulation of a circular jet; Domino, Jofre, and Iaccarino; Center for Turbulence Research Annual Research briefs; Stanford University.
- 2016 Exploring model-form uncertainties in large-eddy simulations; Domino, Jofre, and Iaccarino; Proceedings of the 2016 Center for Turbulence Research Summer Program; Stanford University.
- 2014 A comparison between low-order and higher-order low-Mach discretization approaches; Domino; Proceedings of the 2014 Center for Turbulence Research Summer Program; Stanford University.
- 2013 A reflection of recent ASC milestones in support of the abnormal/thermal environment; Domino; Sandia National Laboratories Technical Report, SAND2013-3927P.
- 2010 Towards verification of sliding mesh algorithms for complex applications using MMS; Domino; Proceedings of the 2010 Center for Turbulence Research Summer Program; Stanford University.

Noteworthy Experiences

- 2018 Guest lecturer for Stanford's ME469 Mechanical Engineering Graduate Computational Fluid Mechanics class.
- 2006-2018 Six-time visiting scholar at Stanford's Center for Turbulence Research.
- 2000-2018 Numerous internal and external peer-review processes supported, e.g., journals, DOE panels, etc.).

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.