Spencer H. Bryngelson

1 Basic information

Title: Assistant Professor, School of Computational Science & Engineering
Assistant Professor by Courtesy (0%), Daniel Guggenheim School of Aerospace Engineering
Assistant Professor by Courtesy (0%), George W. Woodruff School of Mechanical Engineering

Institution: Georgia Institute of Technology

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Citizenship: USA

2 Education

- University of Illinois at Urbana–Champaign
  - (2018) Doctor of Philosophy, Theoretical & Applied Mechanics
    Advisor: Jonathan Freund
  - (2015) Master of Science, Theoretical & Applied Mechanics
  - (2015) Graduate Certificate, Computational Science & Engineering
- University of Michigan–Dearborn
  - (2013) Bachelor of Science, Mechanical Engineering
  - (2013) Bachelor of Science, Engineering Mathematics

3 Positions held

- (2021–Present) Assistant Professor, School of Computational Science & Engineering, College of Computing, Georgia Institute of Technology
- (2023–Present) Assistant Professor by Courtesy (0%), Daniel Guggenheim School of Aerospace Engineering, College of Engineering, Georgia Institute of Technology
- (2024–Present) Assistant Professor by Courtesy (0%), George W. Woodruff School of Mechanical Engineering, College of Engineering, Georgia Institute of Technology
- (2022) Visiting Scholar, Stanford University, Center for Turbulence Research (Summer Program)
- (2018–21) Senior Postdoctoral Scholar, California Institute of Technology, with Tim Colonius
- (2019) Visiting Researcher, Massachusetts Institute of Technology, with Themis Sapsis
- (2018) Postdoctoral Researcher, XPACC (PSAAP II center), with Carlos Pantano, Dan Bodony, Jon Freund
- (2013–17) Graduate Research Fellow, University of Illinois at Urbana–Champaign, with Jon Freund
- (2015) Alumni Teaching Fellow, University of Illinois at Urbana–Champaign
- (2012–13) Undergraduate Research Assistant, University of Michigan–Dearborn, with Eric Ratts

4 Teaching

4.1 Georgia Institute of Technology

Semester	Number	Course Title	Students
Spring 2024	CSE 6730	Modeling & Simulation	163

Fall 2023	VIP X60Y	Student Cluster Competition Team	17
Fall 2023	CX/MATH 4640	Numerical Analysis I	53
Spring 2023	CSE 6730	Modeling & Simulation	146
Fall 2022	CX/MATH 4640	Numerical Analysis I	36
Fall 2022	VIP X60Y	Student Cluster Competition Team	18
Fall 2021	CX/MATH 4640	Numerical Analysis I	43

X=2,3,4; Y=1,2

4.2 Other institutions

Semester	Number	Course Title	Students	Institute
Fall 2015	ME310	Fundamentals of Fluid Dynamics	82	UIllinois
Fall 2013	ME3601	Design and Analysis of Machine Elements	35	UMichigan
Spring 2012	ME364	Probability, Statistics, and Reliability in Design	32	UMichigan
Fall 2012	ME230	Statics and Mechanics of Materials	61	UMichigan

5 Students

5.1 Postdoctoral researchers

- Dr. Tianyi Chu (Ph.D., UC San Diego)

5.2 Doctoral

- Jesus Arias, Ph.D. student (CSE/AE)
- Max Hawkins, Ph.D. student (CSE, co-advised with R. Vuduc)
- Anand Radhakrishnan, Ph.D. student (CSE)
- Zhixin Song, Ph.D. Student (Physics)
- Benjamin Wilfong, Ph.D. student (CSE)
- Haocheng Yu, Ph.D. student (CSE/AE, co-advised with K. Ahuja, L. Sankar)

5.3 Undergraduate

- Ansh Gupta (CS)
- Sriharsha Kocherla (CS)
- Henry Le Berre (CS)
- Suzan Manasreh (CS)
- Lian Xiang (Physics)

5.4 Alumni

Graduate students

- Fatima Ezahra Chrit, Ph.D. ME, co-advised with Alex Alexeev, 2021–23
- Anshuman Sinha, M.S. CSE, 2022–23

Undergraduate students

- Ajay Bati, CS, 2021–23
- Arjun Bhamra, CS, 2022–23
- Rasmit Devkota, Physics, 2023
- Yash Kothari, CS, 2022–23
- Subrahmanyam Mullangi, CS, 2023–24
- Qi Zeng, CS and Math, co-advised with F. Schäfer, 2021–23

5.5 Student and scientist accolades

- (2024) Suzan Manasreh, GT PURA Salary Award
- (2024) Subrahmanyam Mullangi, GT PURA Salary Award
- (2023) Dr. Bryan Gard (GTRI Research Scientist), IRAD of the Year award
- (2023) Qi Zeng, Outstanding Undergraduate Researcher Award, College of Computing (co-advised with F. Schäfer)
- (2023) Ansh Gupta, GT PURA Salary Award
- (2022) Fatima Chrit, Georgia Tech Quantum Alliance Fellowship
- (2022) Zhixin (Jack) Song, GT CRNCH Fellowship
- (2022) Benjamin Wilfong, GT President's Fellowship

6 Awards

- (2022) Ralph E. Powe Junior Faculty Enhancement Award, Oak Ridge National Lab
- (2022–23) Georgia Tech Faculty Writing Scholar
- (2022–23) Class of 1969 Teaching Fellow, Georgia Institute of Technology
- (2018) Stanley Weiss Outstanding Dissertation Award, University of Illinois at Urbana–Champaign
- (2016) Hassan Aref Award (research in fluid mechanics), University of Illinois at Urbana–Champaign
- (2015) Alumni Teaching Fellowship, University of Illinois at Urbana–Champaign
- (2010–13) Dean's List, University of Michigan–Dearborn
- (2011) Pi Tau Sigma (honor society, member), University of Michigan–Dearborn

7 Research support

7.1 Pending grants

- (2024–29) Co-PI: DOE ASCR Accelerated Research in Quantum Computing "*Achieving quantum utility in PDE solutions through particle-based representations*" ($9M, SHB share $1.13M)
- (2024) PI: Lab Directed Research and Development (Lawrence Livermore National Laboratories subcontract), "*Accelerated, Compressed, and Regularized Compute of kinetic-based PDEs*" ($80K)
- (2024–29) PI: DOE Early Career Research Program "*Radial basis function numerics enable massively parallel, high-order accurate, mesh-free, and shock-stable PDE solvers*" ($875K)
- (2024–27) PI: DOD ONR YIP "*Systematic model improvement for reliably predictive simulations of flow-coupled solid-fuel jet engines*" ($750K)
- (2024–27) PI: NSF DARE "*Optimal computational model-based design of affordable wearable technology to monitor biomarkers in kids with enthesitis related arthritis*" ($450K)
- (2024–27) Senior personnel: DARPA Young Faculty Award "*Squid-inspired nozzles for enhanced efficiency and thrust in rotary propulsors*" ($1M)

7.2 Funded grants

- (2024–27) co-PI: DOD ONR N00014-24-1-2094 "*Multi-scale simulations of combustion in a solid propellant ramjet with embedded reactive metal particles*" ($375K, PI S. Menon, GT)
- (2023–28) co-PI: DOD ONR MURI N00014-23-1-2501, "*Combustion of solid fuels in high enthalpy flow*" ($3.8M) PI: G. Young (Virginia Polytechnic Institute and State University), 7 other co-PIs. SHB Share: $270K Y1–3.
- (2023–27) PI: DOD ARO W911NF-23-10324, "*Investigation and inference of soft material deformation mechanisms unlocked at large speeds, finite deformations, and many cycles*," collaborative with University of Michigan, Jon Estrada. (Total: $835K; SHB Share: $314K)
- (2023–24) PI: DOE DE-NA0003525 (Sandia National Laboratories subcontract), "*Vibrated bubbly*

flow simulation" ($100K)

- (2023–24) co-PI: DARPA HR0011-23-3-0006, "*Quantum eigensolvers in fluid-dynamic computations and applications*" ($300K), PI B. Gard (Georgia Tech Research Institute), SHB Share: $100K
- (2022–23) PI: DOE DE-NA0003525 (Sandia National Laboratories subcontract), "*Vibrated bubbly flow simulation*" ($65K)
- (2022–23) PI: DOE ORAU Powe, "*A methodologically coherent multi-scale model for multiphase flow*" ($10K)
- (2022–26) PI: DOD ONR N00014-22-12519, "*Stochastic framework for cavitating flows: mesoscale modeling and acceleration*" ($560K)
- (2022–23) co-PI: GTRI IRAD, "*Quantum optimization for lattice Boltzmann simulation (QOLBS)*" ($40K), PI: B. Gard (Georgia Tech Research Institute)
- (2022) PI: GT Seed Grant, Forming Teams "*Quantum computing for next-generation engineering simulation*" ($50K)
- (2022) PI: GTQA DE-00013211, "*Quantum algorithms for lattice Boltzmann fluid flow simulation*" ($14.5K)

7.3 Miscellaneous grants

- (2023) PI: SIAM CSE Travel Award ($1K)
- (2023) PI: APS FECS Travel Grant ($350)
- (2022) PI: Stanford CTR Summer Program "*Fast macroscopic forcing for operator recovery via locality and causality with application to compressible and multiphase flow*" ($8K, with F. Schäfer, SHB share $4K)

7.4 Funded resource and hardware awards

- (2021–Present) PI: Oak Ridge National Lab CFD154, Director's Discretionary, "*Accelerated sub-grid multi-component flow physics*" (50K node hours+)
- (2021–Present) PI: ACCESS TG-PHY210084, "*High-fidelity simulation of high-speed flowing dispersions via a stochastic sub-grid model*" (1.2M Node Hours+)
- (2024) Co-I: Georgia Tech Tech. Fee, "*Next Generation NVIDIA HPC Cluster*" (4x NVIDIA GraceHopper Superchip nodes, $250K)
- (2022) PI: NVIDIA Academic Hardware Grant Program (4x BlueField-2 E-Series DPU, $12K value)
- (2022) PI: Georgia Tech Tech. Fee "*ARM HPC Dev Kits for next-generation supercomputing*" (10x NVIDIA ARM HPC Dev. Kits, $240K)
- (2022) PI: AMD MI200-series GPU Server ($77K value)
- (2022) PI: NVIDIA Academic Hardware Grant Program (2x A100 80GB PCIe GPUs, $30K value)
- (2019–20) co-PI: XSEDE TG-CTS120005, "*Advanced immersed boundary and interface-capturing methods for simulations of complex flows*" (9M Node Hours, $1.35M value)

8 Professional activity

8.1 Appointments and memberships

- (2022–Present) Association for Computing Machinery (ACM), Member
- (2021–Present) NATO Science & Technology Organization, Technical Team Member
- (2021–Present) American Institute of Aeronautics & Astronautics (AIAA), Member
- (2015–Present) Society of Industrial and Applied Mathematics (SIAM), Member
- (2014–Present) American Physical Society (APS), Member

8.2 Referee

AIAA Journal, Computers in Biology and Medicine, Computer Methods in Applied Mechanics and Engineering, Fluids, IEEE International Parallel & Distributed Processing Symposium, International Journal of Multiphase Flow, International Journal of Offshore and Polar Engineering, Journal of Computational Physics, Journal of Computational Science, Journal of Fluid Mechanics, PEARC (Practice and Experience in Advanced Research Computing), Physical Review E, Physical Review Fluids, PLOS Computational Biology, SC (International Conference for High Performance Computing, Networking, Storage, and Analysis), SIAM Multiscale Modeling & Simulation, SIAM Scientific Computing, Soft Matter, SoftwareX, Symposium of Naval Hydrodynamics, Theoretical and Computational Fluid Dynamics

9 Service and outreach

9.1 Georgia Tech

9.1.1 Institute-level

- (2021–Present) Georgia Tech *HPC Hackathon*, initiator and organizer, recruited sponsors Oak Ridge National Lab and NVIDIA
- (2022–Present) Georgia Tech *Scientific Software Engineering Center*, Advisory Board
- (2022–Present) PURA Award Reviewer
- (2022–Present) ORAU Powe Award Reviewer
- (2022) Faculty Search Panel, Professional Development Workshops, Georgia Tech Center for Teaching and Learning

9.1.2 College-level

- (2022–Present) VIP Team Phoenix–Cluster Competition Team, Faculty advisor
- (2022–Present) CSE communication committee
- (2021–Present) TSO advisory committee representative
- (2021–Present) Seminar series organizer (with F. Schäfer and R. Vuduc)
- (2023) Computational Mathematics Activity Group (organized by N. Chandramoorthy)
- (2023) CRNCH Summit Panel organizer and moderator (with R. Vuduc)
- (2022) Organizer, Georgia Scientific Computing Symposium (with E. Chow and X. Zhang)
- (2022) Judge, CS Junior Design Capstone Expo
- (2021–22) Graduate student admissions committee

9.1.3 Student examination committees

- (2024) Ph.D. Qualifying exam; Jesus Arias (CoC CSE)
- (2024) Ph.D. Thesis proposal; Micaiah Smith-Pierce (CoE AE)
- (2024) Ph.D. Thesis proposal; Sara Karamati (CoC CSE)
- (2023) M.S. Thesis defense; Felix Luo (CoE AE)
- (2023) Ph.D. Qualifying exam; Ayush Jain (CoC CSE)
- (2023) Ph.D. Defense; Fatima Ezahra Chrit (CoE ME)
- (2023) Ph.D. Qualifying exam; Hohyun Lee (CoE ME)
- (2023) Ph.D. Qualifying exam; Grayson Harrington (CoC CSE)
- (2023) M.S. Thesis proposal; Felix Luo (CoE AE)
- (2023) Ph.D. Dissertation proposal; Liana Hatoum (CoE BME)
- (2022) Ph.D. Qualifying exam; Anand Radhakrishnan (CoC CSE)

- (2022) Ph.D. Defense; Wangwei Lan (CoS Physics)
- (2022) Ph.D. Dissertation Proposal; Johnie Sublett (CoC CSE)
- (2022) Ph.D. Qualifying exam; Johnie Sublett (CoC CSE)
- (2022) Ph.D. Defense; Achyut Panchal (CoE AE)
- (2021) Ph.D. Qualifying exam; Bradley Baker (CoC CSE)
- (2021) Ph.D. Qualifying exam; Conlain Kelly (CoC CSE)
- (2021) Ph.D. Qualifying exam; Sam Swanson (CoC CSE)

9.2 External

- (2023) Mini-symposium organizer and session chair, "Statistical Approaches to Closure Modeling in Computational Mechanics," IACM Conference on Mechanistic Machine Learning and Digital Engineering for Computational Science, Engineering & Technology (MMLDT-CSET)
- (2022–Present, quarterly) Panel Referee, ACCESS Maximize
- (2021–Present, annually) Mentor, GPU Hackathons (with Oak Ridge National Lab, NVIDIA, NASA)
- (2023,2021) Poster judge, American Physical Society, Division of Fluid Dynamics
- (2023) Session chair, 11th International Conference on Multiphase Flow
- (2022) Supercomputing (SC) Mentor (via Mentor–Protege program)
- (2022) Supercomputing (SC) Early Career Program
- (2022) Grant Panel Reviewer, National Science Foundation
- (2021, 2022) Session chair, American Physical Society, Division of Fluid Dynamics
- (2021–22) Research mentor, XSEDE EMPOWER (Expert Mentoring Producing Opportunities for Work, Education, and Research; program received HPCwire 2021 Editors' Choice Award in Workforce Diversity and Inclusion Leadership)
- (2021) Mini-symposium organizer and session chair, "Machine learning for multiphase flows," IACM Conference on Mechanistic Machine Learning and Digital Twins for Computational Science, Engineering & Technology (MMLDT-CSET)
- (2020) Research mentor, Schmidt Academy for Software Engineering
- (2019) Research mentor, WAVE undergraduate research program for under-represented students, Caltech
- (2015, 2016) Judge, Illinois State-wide Math Competition
- (2014) Organizer, Science Night, Illinois Middle Schools

10 Media

- (2024) Researchers Blazing New Trails with Superchip Named After Computing Pioneer [LINK]
- (2023) GTRI, Georgia Tech Use Quantum Computing to Optimize CFD Applications [LINK]
- (2023) Group Optimizes Fluid Dynamics Simulator on World's Fastest Supercomputer [LINK]
- (2023) Researchers Optimize HPC Software at Interdisciplinary Hackathon [LINK]
- (2022) New Hardware Brings Students Closer to Exascale Computing [LINK]
- (2022) Faculty Receives New GPUs for Fluid Dynamics and Machine Learning Research [LINK]

11 Publications

Bolding indicates advised or co-advised students and postdocs.

11.1 Preprints

[U4] **Kocherla, S.**, Adams, A., **Song, Z.**, Alexeev, A., Bryngelson, S. H., (2024). "A two-circuit approach to reducing quantum resources for the quantum lattice Boltzmann method". arXiv: 2401.12248. DOI: 10.48550/arXiv.2401.12248.

[U3] **Chrit, F. E.**, **Kocherla, S.**, Gard, B., Dumitrescu, E. F., Alexeev, A., Bryngelson, S. H., (2023). "Fully quantum algorithm for lattice Boltzmann methods with application to partial differential equations". arXiv: 2305.07148. DOI: 10.48550/arXiv.2305.07148.

[U2] Liu, J., Schäfer, F., Bryngelson, S. H., Zaki, T. A., Mani, A., (2023). "Targeted computation of nonlocal closure operators via an adjoint-based macroscopic forcing method". arXiv: 2310.08763. DOI: 10.48550/arXiv.2310.08763.

[U1] **Radhakrishnan, A.**, **Le Berre, H.**, **Wilfong, B.**, Spratt, J.-S., Rodriguez Jr. M., Colonius, T., Bryngelson, S. H., (2023). "Method for portable, scalable, and performant GPU-accelerated simulation of multiphase compressible flow". arXiv: 2305.09163. DOI: 10.48550/arXiv.2305.09163.

11.2 Archival, heavily refereed papers

[P23] **Bati, A.**, Bryngelson, S. H., (2024). "RoseNNa: A performant, portable library for neural network inference with application to computational fluid dynamics". *Computer Physics Communications* **296**, 109052. DOI: 10.1016/j.cpc.2023.109052.

[P22] *Bryngelson, S. H., *Schäfer, F., Liu, J., Mani, A., (2024). "Fast Macroscopic Forcing Method". *Journal of Computational Physics* **499**. *Equal contribution, 112721. DOI: 10.1016/j.jcp.2023.112721.

[P21] **Sinha, A.**, Bryngelson, S. H., (2024). "Neural networks can be FLOP-efficient integrators of 1D oscillatory integrands". *Transactions on Machine Learning Research*. ISSN: 2835-8856.

[P20] Bryngelson, S. H., Fox, R. O., Colonius, T., (2023). "Conditional moment methods for polydisperse cavitating flows". *Journal of Computational Physics* **477**, 111917. DOI: 10.1016/j.jcp.2023.111917.

[P19] Elwasif, W., Bastrakov, S., Bryngelson, S. H., Bussmann, M., Chandrasekaran, S., Ciorba, F., Clark, M. A., Debus, A., Godoy, W., Hagerty, N., Hammond, J., Hardy, D., Harris, J. A., Hernandez, O., Joo, B., Keller, S., Kent, P., **Le Berre, H.**, Lebrun-Grandie, D., MacCarthy, E., Vergara, V. G. M., Messer, B., Miller, R., Oral, S., Piccinali, J.-G., **Radhakrishnan, A.**, Simsek, O., Spiga, F., Steiniger, K., Stephan, J., Stone, J. E., Trott, C., Widera, R., Young, J., (2023). "Early application experiences on a modern GPU-accelerated Arm-based HPC platform". *HPC Asia '23*. International Workshop on Arm-based HPC: Practice and Experience (IWAHPCE). Singapore. DOI: 10.1145/3581576.3581621.

[P18] Firouznia, M., Bryngelson, S. H., Saintillan, D., (2023). "A spectral boundary integral method for simulating electrohydrodynamic flows in viscous drops". *Journal of Computational Physics* **489**, 112248. DOI: 10.1016/j.jcp.2023.112248.

[P17] **Panchal, A.**, Bryngelson, S. H., Menon, S., (2023). "A seven-equation diffused interface method for resolved multiphase flows". *Journal of Computational Physics* **475**, 111870. DOI: 10.1016/j.jcp.2022.111870.

[P16] **Zeng, Q.**, **Kothari, Y.**, Bryngelson, S. H., Schäfer, F., (2023). "Competitive physics informed networks". *International Conference on Learning Representations (ICLR)*. arXiv:2204.11144. Kigali, Rwanda.

[P15] Charalampopoulos, A., Bryngelson, S. H., Colonius, T., Sapsis, T. P., (2022). "Hybrid quadrature moment method for accurate and stable representation of non-Gaussian processes and their dynamics". *Philosophical Transactions of the Royal Society A* **380** 2229. DOI: 10.1098/rsta.2021.0209.

[P14] Bryngelson, S. H., Schmidmayer, K., Coralic, V., Maeda, K., Meng, J., Colonius, T., (2021). "MFC: An open-source high-order multi-component, multi-phase, and multi-scale compressible flow solver". *Computer Physics Communications* **266**, 107396. DOI: 10.1016/j.cpc.2020.107396.

[P13] Spratt, J.-S., Rodriguez, M., Schmidmayer, K., Bryngelson, S. H., Yang, J., Franck, C., Colonius, T., (2021). "Characterizing viscoelastic materials via ensemble-based data assimilation of bubble collapse observations". *Journal of the Mechanics and Physics of Solids* **152**, 104455. DOI: 10.1016/j.jmps.2021.104455.

[P12] Bryngelson, S. H., Charalampopoulos, A., Sapsis, T. P., Colonius, T., (2020). "A Gaussian moment method and its augmentation via LSTM recurrent neural networks for the statistics of cavitating bubble populations". *International Journal of Multiphase Flow* **127**, 103262. DOI: 10.1016/j.ijmultiphaseflow.2020.103262.

[P11] Bryngelson, S. H., Colonius, T., (2020). "Simulation of humpback whale bubble-net feeding models". *Journal of the Acoustical Society of America* **147** 2, 1126–1135. DOI: 10.1121/10.0000746.

[P10] Bryngelson, S. H., Colonius, T., Fox, R. O., (2020). "QBMMlib: A library of quadrature-based moment methods". *SoftwareX* **12**, 100615. DOI: 10.1016/j.softx.2020.100615.

[P9] Schmidmayer, K., Bryngelson, S. H., Colonius, T., (2020). "An assessment of multicomponent flow models and interface capturing schemes for spherical bubble dynamics". *Journal of Computational Physics* **402**, 109080. DOI: 10.1016/j.jcp.2019.109080.

[P8] Trummler, T., Bryngelson, S. H., Schmidmayer, K., Schmidt, S. J., Colonius, T., Adams, N. A., (2020). "Near-surface dynamics of a gas bubble collapsing above a crevice". *Journal of Fluid Mechanics* **899**, A16. DOI: 10.1017/jfm.2020.432.

[P7] Bryngelson, S. H., Freund, J. B., (2019). "Non-modal Floquet stability of a capsule in large amplitude oscillatory extension". *European Journal of Mechanics B/Fluids* **77**, 171–176. DOI: 10.1016/j.euromechflu.2019.04.012.

[P6] Bryngelson, S. H., Guéniat, F., Freund, J. B., (2019). "Irregular dynamics of cellular blood flow in a model microvessel". *Physical Review E* **100**, 012203. DOI: 10.1103/PhysRevE.100.012203.

[P5] Bryngelson, S. H., Schmidmayer, K., Colonius, T., (2019). "A quantitative comparison of phase-averaged models for bubbly, cavitating flows". *International Journal of Multiphase Flow* **115**, 137–143. DOI: 10.1016/j.ijmultiphaseflow.2019.03.028.

[P4] Bryngelson, S. H., Freund, J. B., (2018). "Floquet stability analysis of capsules in viscous shear flow". *Joural of Fluid Mechanics* **852**, 663–677. DOI: 10.1017/jfm.2018.574.

[P3] Bryngelson, S. H., Freund, J. B., (2018). "Global stability of flowing red blood cell trains". *Physical Review Fluids* **3** 7, 073101. DOI: 10.1103/PhysRevFluids.3.073101.

[P2] Bryngelson, S. H., Freund, J. B., (2016). "Buckling and its effect on the confined flow of a model capsule suspension". *Rheologica Acta* **55** 6, 451–464. DOI: 10.1007/s00397-015-0900-9.

[P1] Bryngelson, S. H., Freund, J. B., (2016). "Capsule-train stability". *Physical Review Fluids* **1** 3, 033201. DOI: 10.1103/PhysRevFluids.1.033201.

11.3 Conference papers

[C15] **Le Berre, H. A.**, **Radhakrishnan, A.**, Bryngelson, S. H., (2023). "Fast simulation of multiphase compressible flows thorugh GPU acceleration". *11th International Conference on Multiphase Flow*. Kobe, Japan.

[C14] **Radhakrishnan, A.**, **Le Berre, H. A.**, Bryngelson, S. H., Chreim, J. R., Colonius, T., (2023). "A stochastic computational method for bubbly flows with first steps towards representing inception". *11th International Conference on Multiphase Flow*. Kobe, Japan.

[C13] Bryngelson, S. H., Charalampopoulos, A., Sapsis, T. P., Fox, R. O., Colonius, T., (2022). "Representing statistics of dispersions via moment methods and recurrent neural networks with application to cavitating bubbles". *34th Symposium on Naval Hydrodynamics*. Washington D.C., USA.

[C12] Bryngelson, S. H., Schäfer, F., Liu, J., Mani, A., (2022). "Fast Macroscopic Forcing Method". *Center for Turbulence Research, Proceedings of the Summer Program*. Stanford, CA, USA.

[C11] **Radhakrishnan, A.**, **Le Berre, H.**, Bryngelson, S. H., (2022). "Scalable GPU accelerated simulation of multiphase compressible flow". *The International Conference for High Performance Computing, Networking, Storage, and Analysis (SC)*. Dallas, TX, USA.

[C10] Rodriguez, M., Bryngelson, S. H., Colonius, T., (2022). "Bubble dynamics with phase change near a compliant object". *34th Symposium on Naval Hydrodynamics*. Washington D.C., USA.

[C9] Bryngelson, S. H., Colonius, T., (2021). "Closure of phase-averaged bubbly, cavitating flow models". *XXV International Congress of Theoretical and Applied Mechanics*. Milano, Italy. URL: https://vimeo.com/640932583/0ae772bf00.

[C8] Bryngelson, S. H., O'Meally, F., Colonius, T., Fox, R. O., (2021). "Conditional moment method for fully-coupled phase-averaged cavitation models". *11th International Symposium on Cavitation*. Daejeon, Korea. URL: https://vimeo.com/640931949/a6cd12fc05.

[C7] Rodriguez, M., Bryngelson, S. H., Cao, S., Colonius, T., (2021). "A unified Eulerian multiphase framework for fluid-structure interaction problems including cavitation". *XXV International Congress of Theoretical and Applied Mechanics*. Milano, Italy.

[C6] Rodriguez, M., Bryngelson, S. H., Cao, S., Colonius, T., (2021). "Acoustically-induced bubble growth and phase change dynamics near compliant surfaces". *11th International Symposium on Cavitation*. Daejeon, Korea.

[C5] Spratt, J.-S., Rodriguez, M., Bryngelson, S. H., Cao, S., Colonius, T., (2021). "Eulerian framework for bubble-cloud-kidney stone interaction". *11th International Symposium on Cavitation*. Daejeon, Korea.

[C4] Bryngelson, S. H., Colonius, T., (2020). "Phase- and mixture-averaged techniques for general bubbly flows". *33rd Symposium on Naval Hydrodynamics*. Osaka, Japan. URL: https://vimeo.com/640930931/6e57ccfd89.

[C3] Bryngelson, S. H., Colonius, T., (2019). "A comparison of ensemble- and volume-averaged bubbly flow models". *10th International Conference on Multiphase Flow*. Rio de Janeiro, Brazil.

[C2] Bryngelson, S. H., Freund, J. B., (2016). "Buckling and the rheology of an elastic capsule suspension". *XXIV International Congress of Theoretical and Applied Mechanics*. Montreal, Canada.

[C1] Freund, J. B., Bryngelson, S. H., (2016). "The stability of flowing trains of confined red blood cells". *XXIV International Congress of Theoretical and Applied Mechanics*. Montreal, Canada.

11.4 Other publications

[O2] Bryngelson, S. H., Pantano, C., Bodony, D., Freund, J. B., (2018). *Adjoint-based sensitivity for flows with shocks*. Technical Report, XPACC.

[O1] Bryngelson, S. H. (2017). "Stability and transition of capsule-flow systems". Ph.D. Thesis. University of Illinois at Urbana–Champaign.

12 Talks

12.1 Invited talks

[I32] CRNCH Summit, *Center for Research into Novel Computing Hierarchies*, (2024).

[I31] Naval Surface Warfare Center, Carderock Division, *Quantum Science Seminar*, (2024).

[I30] Bayer AG, *Field Data Science Seminar*, (2023).

[I29] Georgia Institute of Technology, *George W. Woodruff School of Mechanical Engineering Seminar Series*, (2023).

[I28] Google, *Applied Science Seminar Series*, (2023).

[I27] Lawrence Livermore National Laboratory, *Data-driven Physics Simulation Webinar*, (2023). URL: https://www.youtube.com/watch?v=zm-iF1FtkLE.

[I26] OpenACC Webinar, (2023). URL: https://www.youtube.com/watch?v=S0gRVIkNYPg.

[I25] University of Illinois at Urbana–Champaign, *Mechanical Science and Engineering Fluids Seminar*, (2023).

[I24] Arizona State University, *Fluids Seminar*, (2022).

[I23] Brown University, *Center for Fluid Mechanics, Applied Math and Engineering*, (2022).

[I22] CRNCH Summit, *Center for Research into Novel Computing Hierarchies*, (2022). URL: https://mediaspace.gatech.edu/media/CRNCH+Summit+2022+-+Spencer+Bryngleson+-+Quantum+Computing+for+Continuum+Mechanics/1_23u8ou36.

[I21] Emory University, *Scientific Computing Seminar Series*, (2022).

[I20] Georgia Institute of Technology, *Applied and Computational Math Seminar Series*, (2022).

[I19] Georgia Institute of Technology, *Daniel Guggenheim School of Aerospace Engineering Seminar Series*, (2022). URL: https://vimeo.com/759713173/12ef9a0220.

[I18] Georgia Scientific Computing Symposium, (2022).

[I17] Massachusetts Institute of Technology, *SAND Group*, (2022).

[I16] Office of Naval Research, *Basic Research Challenge Guest Talks*, (2022).

[I15] California Institute of Technology, *Mechanical and Civil Engineering Seminar Series*, (2021).

[I14] OpenACC Annual Summit, (2021). URL: https://youtu.be/DgX6ssX2yrg.

[I13] University of California, San Diego, *Fluid Mechanics, Combustion, & Engineering Physics Seminar Series*, (2021). URL: https://vimeo.com/640930056/b1a6c0dc62.

[I12] Georgia Institute of Technology, *Computational Science & Engineering Seminar Series*, (2020).

[I11] Massachusetts Institute of Technology, *SAND Group*, (2019).

[I10] University of Michigan–Ann Arbor, *Mechanical Engineering Seminar Series*, (2019).

[I9] University of Michigan–Dearborn, *Mechanical Engineering Seminar Series*, (2019).

[I8] University of Utah, *Mechanical Engineering Seminar Series*, (2019).

[I7] University of Vermont, *Mechanical Engineering Seminar Series*, (2019).

[I6] University of Washington, *Mechanical Engineering Seminar Series*, (2019).

[I5] California Institute of Technology, *Computational Flow Physics Group*, (2018).

[I4] California Institute of Technology, *Flow Mechanics Research Conference*, (2018).

[I3] ETH Zurich, *Computational Science & Engineering Lab*, (2017).

[I2] University of Illinois at Urbana–Champaign, *Fluid Mechanics Seminar*, (2017).

[I1] University of Illinois at Urbana–Champaign, *Biology Interest Group*, (2015).

12.2 Conference presentations

[T53] **Radhakrishnan, A.**, **Le Berre, H.**, **Wilfong, B.**, Budiardja, R., Abbott, S., Bryngelson, S. H., (2024). "Compressible multi-species flow simulation on OLCF Frontier via OpenACC". *American Physical Society, March Meeting*.

[T52] **Song, Z.**, Gard, B., Bryngelson, S. H., (2024). "Incompressible flow simulation via a hybrid quantum-classical approach and variational algorithm". *American Physical Society, March Meeting*.

[T51] **Arias, J. E.**, Bryngelson, S. H., (2023). "Towards stable shock-capturing via radial basis finite differences on unstructured point clouds". *Americal Physical Society, Division of Fluid Dynamics*.

[T50] Bryngelson, S. H. (2023). "Stochastic sub-grid methods for multiphase flows at scale". *Workshop on Compressible Multiphase Flows, Stanford University*.

[T49] Bryngelson, S. H., **Le Berre, H.**, **Radhakrishnan, A.,** (2023). "Compressible multiphase flow simulation at near-exascale via a scalable GPU implementation". *American Physical Society, March Meeting*.

[T48] Bryngelson, S. H., Schäfer, F., Liu, J., Mani, A., (2023). "Super-spectral operator recovery via the fast macroscopic forcing method". *SIAM Computational Science and Engineering*.

[T47] Firouznia, M., Bryngelson, S. H., Saintillan, D., (2023). "A spectral boundary element method for interfacially driven flows". *8th Micro and Nano Flows Conference*.

[T46] **Kocherla, S.**, Bryngelson, S. H., (2023). "Reducing quantum resources for the quantum lattice Boltzmann method". *Americal Physical Society, Division of Fluid Dynamics*.

[T45] Lee, H., Bryngelson, S. H., Colonius, T., (2023). "Cavitation inception in a turbulent mixing layer". *Americal Physical Society, Division of Fluid Dynamics*.

[T44] Liu, J., Bryngelson, F. S. S. H., Zaki, T., Mani, A., (2023). "Adjoint macroscopic forcing method for computing the nonlocal eddy viscosity in a turbulent channel flow". *Americal Physical Society, Division of Fluid Dynamics*.

[T43] Liu, J., Bryngelson, F. S. S. H., Zaki, T., Mani, A., (2023). "Targeted quantification of nonlocal closure operators using an adjoint-based macroscopic forcing method". *International Association for Computational Mechanics MMLDE-CSET*.

[T42] **Radhakrishnan, A.**, Bryngelson, S. H., (2023). "A statistical model for cavitation inception at the sub-grid scale". *Americal Physical Society, Division of Fluid Dynamics*.

[T41] Schäfer, F., Anandkumar, A., Bryngelson, S. H., **Kothari, Y.**, Owhadi, H., **Zeng, Q.**, Zheng, H., (2023). "Competitive gradient descent algorithms". *SIAM Computational Science and Engineering*.

[T40] **Song, Z.**, Bryngelson, S. H., (2023). "Tutorial: Solving partial differential equations (PDEs) with quantum computers". *QCE23: 2023 IEEE International Conference on Quantum Computing & Engineering*.

[T39] **Song, Z.**, Gard, B., Bryngelson, S. H., (2023). "Hybrid classical-quantum algorithm for solving the incompressible Navier–Stokes equations on quantum hardware". *Americal Physical Society, Division of Fluid Dynamics*.

[T38] **Arias, J. E.**, Bryngelson, S. H., (2022). "Radial-basis-function-based numerical methods for solving compressible flow equations at different Mach numbers". *American Physical Society, Division of Fluid Dynamics*.

[T37] **Bati, A.**, Bryngelson, S. H., (2022). "RoseNNa: A performant library for portable neural network inference with application to CFD". *American Physical Society, Division of Fluid Dynamics*.

[T36] Bryngelson, S. H. (2022). "Fast integration methods for averaging bubble dynamics at sub-grid scales". *19th U.S. National Congress on Theoretical and Applied Mechanics*.

[T35] Bryngelson, S. H., Schäfer, F., Liu, J., Mani, A., (2022). "Fast Macroscopic Forcing: Exploiting locality for operator recovery". *American Physical Society, Division of Fluid Dynamics*.

[T34] **Chrit, F. E.**, **Kocherla, S.**, Adams, A., Young, J., Alexeev, A., Bryngelson, S. H., (2022). "Quantum lattice algorithms for solving partial differential equations". *17th Conference on Theory of Quantum Computation, Communication, and Cryptography*.

[T33] **Chrit, F. E.**, **Kocherla, S.**, Alexeev, A., Bryngelson, S. H., (2022). "Quantum lattice gas algorithm for fluid flow simulations". *American Physical Society, Division of Fluid Dynamics*.

[T32] Colonius, T., Bryngelson, S. H., (2022). "Hybrid quadrature moment methods for polydisperse cavitating flows". *1st European–American–Japanese Two-Phase Flow Group Meeting*.

[T31] Firouznia, M., Bryngelson, S. H., Saintillan, D., (2022). "A spectral boundary integral method for simulating electrohydrodynamic flows in liquid droplets". *American Physical Society, Division of Fluid Dynamics*.

[T30] **Panchal, A.**, **Radhakrishnan, A.**, Bryngelson, S. H., Menon, S., (2022). "A numerical comparison of 5-, 6-, and 7-equation Baer-Nunziato-based diffuse interface methods". *American Physical Society, Division of Fluid Dynamics*.

[T29] **Radhakrishnan, A.**, **Le Berre, H.**, Bryngelson, S. H., (2022). "Towards exascale multiphase compressible flow simulation via scalable interface capturing-based solvers and GPU acceleration". *American Physical Society, Division of Fluid Dynamics*.

[T28] Rodriguez, M., Bryngelson, S. H., (2022). "Cavitation bubble growth near an elastic object". *American Physical Society, Division of Fluid Dynamics*.

[T27] Rodriguez, M., Bryngelson, S. H., Colonius, T., (2022). "Numerical simulations of cavitation near an elastic object". *ECCOMAS Congress*.

[T26] Rodriguez, M., Spratt, J.-S., Bryngelson, S. H., Colonius, T., (2022). "Numerical simulations of cavitation bubble growth and collapse near a viscoelastic object". *19th U.S. National Congress on Theoretical and Applied Mechanics*.

[T25] Spratt, J., Rodriguez, M., Bryngelson, S. H., Colonius, T., (2022). "Numerical simulations of ablation mechanisms during focused ultrasound therapies". *American Physical Society, Division of Fluid Dynamics*.

[T24] **Zeng, Q.**, Bryngelson, S. H., Schäfer, F., (2022). "Competitive physics informed networks". *ICLR workshop "Gamification and Multiagent Solutions"*.

[T23] Bryngelson, S. H., Charalampopoulos, A., Fox, R. O., Sapsis, T., Colonius, T., (2021). "Bypassing quadrature moment method instability via recurrent neural networks with application to cavitating bubble dispersions". *American Physical Society, Division of Fluid Dynamics*. URL: https://vimeo.com/650700675/06006b48de.

[T22] Bryngelson, S. H., Charalampopoulos, A., Sapsis, T., Colonius, T., (2021). "Machine learned model for non-Gaussian cavitation statistics". *International Association for Computational Mechanics MMLDT-CSET*.

[T21] Bryngelson, S. H., Colonius, T., (2021). "Statistical model for cavitating polydisperse bubble clouds". *Journal of the Acoustical Society of America*. URL: https://vimeo.com/640933361/4f9d1469ce.

[T20] Bryngelson, S. H., Colonius, T., (2021). "Sub-grid population balance model for cavitating flows". *14th Southern California Flow Physics Symposium*.

[T19] Bryngelson, S. H., Wang, Q., Cisneros-Garibay, E., Colonius, T., (2021). "GPU-accelerated quadrature moment methods". *SIAM Annual Meeting*.

[T18] Rodriguez, M., Bryngelson, S. H., Colonius, T., (2021). "Acoustically induced bubble growth with phase change". *14th Southern California Flow Physics Symposium*.

[T17] Rodriguez, M., Bryngelson, S. H., Colonius, T., (2021). "Vapor and gas bubble growth with phase transition near a wall". *American Physical Society, Division of Fluid Dynamics*.

[T16] Spratt, J.-S., Rodriguez, M., Bryngelson, S. H., Cao, S., Colonius, T., (2021). "High fidelity single framework simulations of acoustic wave–bubble cloud–elastic solid interactions". *American Physical Society, Division of Fluid Dynamics*.

[T15] Spratt, J.-S., Rodriguez, M., Bryngelson, S. H., Cao, S., Colonius, T., (2021). "Numerical Simulations of burst-wave lithotripsy in an Eulerian framework". *14th Southern California Flow Physics Symposium*.

[T14] Spratt, J.-S., Rodriguez, M., Bryngelson, S. H., Cao, S., Colonius, T., (2021). "Single-framework simulations of acoustic-wave–bubble cloud–stone interactions". *Journal of the Acoustical Society of America*.

[T13] Bryngelson, S. H., Fox, R., Colonius, T., (2020). "Conditioned quadrature moment methods for cavitating bubble dispersions". *American Physical Society, Division of Fluid Dynamics*. URL: https://vimeo.com/640933407/2830fcf3e0.

[T12] Rodriguez, M., Bryngelson, S. H., Colonius, T., (2020). "Cavitation bubble growth with phase transition near a rigid wall". *American Physical Society, Division of Fluid Dynamics*.

[T11] Spratt, J.-S., Rodriguez, M., Bryngelson, S. H., Colonius, T., (2020). "A fully Eulerian simulation framework for cavitating bubble-clouds near viscoelastic materials". *American Physical Society, Division of Fluid Dynamics*.

[T10] Bryngelson, S. H., Charalampopoulos, A., Sapsis, T. P., Colonius, T., (2019). "Neural-network-augmented Gaussian moment method for the statistics of cavitating bubble populations". *American Physical Society, Division of Fluid Dynamics*.

[T9] Bryngelson, S. H., Colonius, T., (2019). "Annular and spiral bubble nets: A simulation-focused analysis of humpback whale feeding strategies". *Journal of the Acoustical Society of America, 146(4) 2771*.

[T8] Bryngelson, S. H., Colonius, T., (2019). "Simulations and acoustics of humpback whale bubble-net feeding". *13th Southern California Flow Physics Symposium*.

[T7] Trummler, T., Schmidmayer, K., Bryngelson, S. H., Colonius, T., (2019). "Simulations of a collapsing gas bubble above a crevice". *13th Southern California Flow Physics Symposium*.

[T6] Bryngelson, S. H., Colonius, T., (2018). "Modeling approaches for bubbly, cavitating flows". *American Physical Society, Division of Fluid Dynamics*.

[T5] Bryngelson, S. H., Freund, J. B., (2017). "Floquet stability of tank-treading and tumbling capsules in viscous shear flow". *American Physical Society, Division of Fluid Dynamics*.

[T4] Bryngelson, S. H., Freund, J. B., (2017). "Global stability of fully coupled capsule flow systems". *SIAM Computational Science and Engineering*.

[T3] Bryngelson, S. H., Freund, J. B., (2017). "Stability of flowing red blood cell trains". *Blood Flow*.

[T2] Bryngelson, S. H., Freund, J. B., (2016). "Stability and transition to chaos of regular capsule trains". *American Physical Society, Division of Fluid Dynamics*.

[T1] Bryngelson, S. H., Freund, J. B., (2015). "Buckling and its effect on the confined flow of a capsule suspension". *American Physical Society, Division of Fluid Dynamics*.

13 Software

Our open source software is located at `github.com/comp-physics`, below is an autogenerated listing:

Name (click for Github repo.)	**Description**
`RBC3D`	3D Spectral boundary integral solver for cell-scale blood flow
`MeshfreeTrixi.jl`	Meshfree extension to Trixi using RBF-based numerics.
`MeshfreeTrixiDev`	Repository for development and testing of MeshfreeTrixi.jl
`group-docs`	Group syllabus
`Quantum-PDE-Benchmark`	Benchmark near-term quantum algorithms for Partial Differential Equations (PDEs)
`Scientific-Visualization`	Scientific visualization tutorials using Paraview.
`deepOscillations`	Flop-efficient neural integration
`RadialBasisFiniteDifferences.jl`	Library for efficient RBF-FD
`QLBM-frugal`	A resource frugal quantum lattice Boltzmann method
`fast-mfm`	Fast Macroscopic Forcing Method
`awesome-numerics`	Resources for learning about numerical methods.
`qce23-qpde-tutorial`	Solving PDEs with quantum algorithms: A tutorial at IEEE QCE 2023
`roseNNa`	A fast minimally-intrusive neural network inference library
`PyQBMMlib`	PyQBMMlib is a Python extension of QBMMlib.
`EnsAvg-1D-Tait`	1D Ensemble-averaging solver for dilute cavitating bubbly flows. Finite volume with WENO/Riemann solvers.
`fully-QLBM`	Code accompanying quantum LBM paper
`awesome-modeling-simulation`	Resources for learning about modeling and simulation
`CPINN`	Competitive Physics Informed Networks
`hip-stencil-code`	Stencil code for AMD GPUs
`RBC2D`	2D Spectral boundary integral solver for cell-scale blood flow
`QBMMlib`	Mathematica package for quadrature-based moment methods and population balance equations.
`PyCav`	Dynamics of cavitating bubble populations
`bubble-dynamics-resnet`	Integrate bubble dynamics faster!
`xacc-examples`	Misc. XACC info.
`fvm-risc`	Benchmarking FVMs on different hardware and under different optimizations
`IMR-archive`	Inertial Microcavitation Rheometry
`WENO-scalar`	A WENO solver for 1D scalar PDEs
`WENO-NN`	A modified WENO method that improves interface sharpness via neural networks.

We develop and maintain `MFC`, an exascale multiphase and multiphysics fluid flow solver:

Name (click for Github repo.)	**Description**
`MFC`	Exascale multiphase flow simulation

We also work on Inertial Microcaviation Rheometry (IMR) software:

Name (click for Github repo.)	**Description**
IMR-data-assimilation	IMR with Data Assimilation
IMR-simple	MATLAB simple codes to numerically simulate laser/ultrasound-induced inertial cavitation bubble dynamics in soft materials
IMR-v1	Vanilla IMR codebase
inca	InertialCav supported by J. Estrada's group