

Spencer H. Bryngelson

I Basic information

Title: Assistant Professor, School of Computational Science & Engineering

Institution: Georgia Institute of Technology

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2 Education

- University of Illinois at Urbana–Champaign
 - (2017) Doctor of Philosophy, Theoretical & Applied Mechanics
 - (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 Research positions

- (2021–Present) Assistant Professor, School of Computational Science & Engineering, College of Computing, Georgia Institute of Technology
- (2018–21) Senior Postdoctoral Scholar, California Institute of Technology, with Tim Colonius
- (2019) Visiting Researcher, Massachusetts Institute of Technology, with Themis Sapsis
- (2017–18) 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
- (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 | TAT |
|-----------|-------------------|----------------------|----------|-----|
| Fall 2021 | CX 4640/MATH 4640 | Numerical Analysis I | 43 | Yes |

*TAT: Thank a Teacher Award received

4.2 Other Institutions

| Semester | Number | Course Title | Students | Institute |
|-------------|---------|--|----------|-----------|
| Fall 2015 | ME 310 | Fundamentals of Fluid Dynamics | 82 | Uillinois |
| Fall 2013 | ME 3601 | Design and Analysis of Machine Elements | 35 | UMichigan |
| Spring 2012 | ME 364 | Probability, Statistics, and Reliability in Design | 32 | UMichigan |
| Fall 2012 | ME 230 | Statics and Mechanics of Materials | 61 | UMichigan |

5 Students

5.1 Graduate

- Jesus Arias, Ph.D. student (CSE, co-advised with L. Sankar)
- Fatima Ezahra Chrit, Ph.D. student (ME and CSE, co-advised with A. Alexeev)
- Anand Radhakrishnan, Ph.D. student (CSE)
- Scott Sims, M.S. student (CSE)

5.2 Undergraduate

- Ajay Bati (CS)
- Girish Ganesan, Rutgers University (via XSEDE EMPOWER)
- Sriharsha Kocherla (jointly-enrolled high school student)
- Henry Le Berre (CS)
- Qi Zeng (CS and Math, co-advised with F. Schäfer)

6 Awards

- (2017) 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 Funded grants

- (2022) co-PI: GTRI IRAD, “*Quantum optimization for lattice Boltzmann simulation (QOLBS)*” (\$20K), PI B. Gard (GTRI)
- (2022) PI: GTQA DE00013211, “*Quantum algorithms for lattice Boltzmann fluid flow simulation*” (\$14.5K)

7.2 Funded resource and hardware awards

- (2022) PI: Stanford CTR Summer Program “*Fast macroscopic forcing for operator recovery via locality and causality with application to compressible and multiphase flow*” (\$10K, co-PI F. Schäfer, SHB share \$5K)
- (2022) PI: NVIDIA Academic Hardware Grant Program (2x A100 80GB PCIe, \$30K value)
- (2021–22) PI: XSEDE TG-PHY210084, “*High-fidelity simulation of high-speed flowing dispersions via a stochastic sub-grid model*” (200K Node Hours, \$30K value)
- (2021–22) PI: Oak Ridge National Lab CFD154, Director’s Discretionary, “*Accelerated sub-grid multi-component flow physics*” (10K Node Hours)
- (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)

7.3 Pending grants

- (2022–26) PI: DOD ONR I3517745, “*Stochastic framework for cavitating flows: mesoscale modeling and acceleration*” (\$750K)
- (2022–25) co-PI: NSF OAC CORE 21-616, “*Enabling rapid, targeted optimization of PDE solvers via hardware–software coupled autotuning for novel architectures*” (SHB share: \$300K, Total: \$600K)

- (2022–23) co-PI: NOAA SBIR OAR-TPO 2007117 “*Using bubbles to reduce underwater noise from ships and ferries*” (SHB share: \$39K, Total: \$125K)
- (2022) PI: GT Seed Grant, Forming Teams “*Quantum computing for next-generation engineering simulation*” (\$50K)
- (2022) PI: ORAU Powe, “*A methodologically coherent multi-scale model for multiphase flow*” (\$10K)
- (2022) PI: Georgia Tech TechFee “*ARM HPC Dev Kits for next-generation supercomputing*” (8x NVIDIA HPC Dev. Kits, \$700K value)

7.4 Rejected proposals

- (2022–27) co-PI: DOE EFRC 0002653 “*Quantum Information and Energy Science Center (QuIES-Cent)*” (SHB share: \$2M, Total: \$16M)

8 Professional activity

8.1 Referee

- AIAA Journal
- Fluids
- International Journal of Multiphase Flow
- International Journal of Offshore and Polar Engineering
- Journal of Computational Physics
- Journal of Fluid Mechanics
- Physical Review E
- Physical Review Fluids
- PLOS Computational Biology
- Symposium of Naval Hydrodynamics
- Theoretical and Computational Fluid Dynamics

8.2 Appointments and memberships

- (2021–22) NATO Science & Technology Organization, Technical Team Member
- (2015–Present) Society of Industrial and Applied Mathematics, Member
- (2014–Present) American Physical Society, Member

9 Service and outreach

9.1 Georgia Tech

9.1.1 Institute-level

- (2022–Present) Georgia Tech *Scientific Software Engineering Center*, Advisory Board
- (2021–Present) Georgia Tech *HPC Hackathon*, initiator and organizer, recruited sponsors Oak Ridge National Lab and NVIDIA

9.1.2 CoC CSE school-level

- (2022) Organizer, Georgia Scientific Computing Symposium (with E. Chow and X. Zhang)
- (2021–Present) TSO advisory committee representative
- (2021–Present) Seminar series organizer (with F. Schäfer and R. Vuduc)
- (2021–Present) Graduate student admissions committee

9.1.3 Student examination committees

- (2022) Ph.D. defense, Achyut Panchal (CoE AE)
- (2021) Qualifying exam, Bradley Baker (CoC CSE)
- (2021) Qualifying exam, Conlain Kelly (CoC CSE)
- (2021) Qualifying exam, Sam Swanson (CoC CSE)

9.2 External

- (2021–Present) 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–Present) Mentor, GPU Hackathons (with Oak Ridge National Lab and NVIDIA)
- (2021) Poster judge, American Physical Society, Division of Fluid Dynamics
- (2021) Session chair, American Physical Society, Division of Fluid Dynamics
- (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
- (2015–16) Judge, Illinois State-wide Math Competition
- (2014) Organizer, Science Night, Illinois Middle Schools

10 Publications

10.1 Preprints

- [P1] Bryngelson, S. H., R. O. Fox, and T. Colonius (2021). “Conditional moment methods for polydisperse cavitating flows”. arXiv: 2112.14172.

10.2 Journal papers

- [J15] Charalampopoulos, A., S. H. Bryngelson, T. Colonius, and T. P. Sapsis (2022). “Hybrid quadrature moment method for accurate and stable representation of non-Gaussian processes and their dynamics”. *Philosophical Transactions of the Royal Society A*. in press [arXiv: 2110.01374].
- [J14] Bryngelson, S. H., K. Schmidmayer, V. Coralic, K. Maeda, J. Meng, and T. Colonius (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](https://doi.org/10.1016/j.cpc.2020.107396).
- [J13] Spratt, J.-S., M. Rodriguez, K. Schmidmayer, S. H. Bryngelson, J. Yang, C. Franck, and T. Colonius (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](https://doi.org/10.1016/j.jmps.2021.104455).
- [J12] Bryngelson, S. H., A. Charalampopoulos, T. P. Sapsis, and T. Colonius (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](https://doi.org/10.1016/j.ijmultiphaseflow.2020.103262).
- [J11] Bryngelson, S. H. and T. Colonius (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](https://doi.org/10.1121/10.0000746).
- [J10] Bryngelson, S. H., T. Colonius, and R. O. Fox (2020). “QBMMlib: A library of quadrature-based moment methods”. *SoftwareX* **12**, 100615. DOI: [10.1016/j.softx.2020.100615](https://doi.org/10.1016/j.softx.2020.100615).

- [J9] Schmidmayer, K., S. H. Bryngelson, and T. Colonius (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](https://doi.org/10.1016/j.jcp.2019.109080).
- [J8] Trummler, T., S. H. Bryngelson, K. Schmidmayer, S. J. Schmidt, T. Colonius, and N. A. Adams (2020). “Near-surface dynamics of a gas bubble collapsing above a crevice”. *Journal of Fluid Mechanics* **899**, A16. DOI: [10.1017/jfm.2020.432](https://doi.org/10.1017/jfm.2020.432).
- [J7] Bryngelson, S. H. and J. B. Freund (2019). “Non-modal Floquet stability of a capsule in large amplitude oscillatory extension”. *European Journal of Mechanics B* **77**, 171–176. DOI: [10.1016/j.euromechflu.2019.04.012](https://doi.org/10.1016/j.euromechflu.2019.04.012).
- [J6] Bryngelson, S. H., F. Guéniat, and J. B. Freund (2019). “Irregular dynamics of cellular blood flow in a model microvessel”. *Physical Review E* **100**, 012203. DOI: [10.1103/PhysRevE.100.012203](https://doi.org/10.1103/PhysRevE.100.012203).
- [J5] Bryngelson, S. H., K. Schmidmayer, and T. Colonius (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](https://doi.org/10.1016/j.ijmultiphaseflow.2019.03.028).
- [J4] Bryngelson, S. H. and J. B. Freund (2018). “Floquet stability analysis of capsules in viscous shear flow”. *Journal of Fluid Mechanics* **852**, 663–677. DOI: [10.1017/jfm.2018.574](https://doi.org/10.1017/jfm.2018.574).
- [J3] Bryngelson, S. H. and J. B. Freund (2018). “Global stability of flowing red blood cell trains”. *Physical Review Fluids* **3** 7, 073101. DOI: [10.1103/PhysRevFluids.3.073101](https://doi.org/10.1103/PhysRevFluids.3.073101).
- [J2] Bryngelson, S. H. and J. B. Freund (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](https://doi.org/10.1007/s00397-015-0900-9).
- [J1] Bryngelson, S. H. and J. B. Freund (2016). “Capsule-train stability”. *Physical Review Fluids* **1** 3, 033201. DOI: [10.1103/PhysRevFluids.1.033201](https://doi.org/10.1103/PhysRevFluids.1.033201).

10.3 Refereed conference papers

- [C11] Bryngelson, S. H., A. Charalampopoulos, T. P. Sapsis, R. O. Fox, and T. Colonius (2022). “Representing statistics of dispersions via moment methods and recurrent neural networks with application to cavitating bubbles”. *34rd Symposium on Naval Hydrodynamics*. Washington D.C., USA.
- [C10] Rodriguez, M., S. H. Bryngelson, and T. Colonius (2022). “Bubble dynamics with phase change near a compliant object”. *34rd Symposium on Naval Hydrodynamics*. Washington D.C., USA.
- [C9] Bryngelson, S. H. and T. Colonius (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., F. O’Meally, T. Colonius, and R. O. Fox (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., S. H. Bryngelson, S. Cao, and T. Colonius (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., S. H. Bryngelson, S. Cao, and T. Colonius (2021). “Acoustically-induced bubble growth and phase change dynamics near compliant surfaces”. *11th International Symposium on Cavitation*. Daejeon, Korea.
- [C5] Spratt, J.-S., M. Rodriguez, S. H. Bryngelson, S. Cao, and T. Colonius (2021). “Eulerian framework for bubble-cloud-kidney stone interaction”. *11th International Symposium on Cavitation*. Daejeon, Korea.

- [C4] Bryngelson, S. H. and T. Colonius (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. and T. Colonius (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. and J. B. Freund (2016). “Buckling and the rheology of an elastic capsule suspension”. *XXIV International Congress of Theoretical and Applied Mechanics*. Montreal, Canada.
- [C1] Freund, J. B. and S. H. Bryngelson (2016). “The stability of flowing trains of confined red blood cells”. *XXIV International Congress of Theoretical and Applied Mechanics*. Montreal, Canada.

10.4 Other publications

- [O2] Bryngelson, S. H., C. Pantano, D. Bodony, and J. B. Freund (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.

II Talks

II.1 Invited talks

- [I22] Arizona State University, *Fluids Seminar* (2022).
- [I21] Brown University, *Center for Fluid Mechanics, Applied Math and Engineering* (2022).
- [I20] CRNCH Summit (2022). URL: https://mediaspace.gatech.edu/media/CRNCH+Summit+2022+-+Spencer+Bryngleson+-+Quantum+Computing+for+Continuum+Mechanics/1_23u8ou36.
- [I19] Emory University, *Scientific Computing Seminar Series* (2022).
- [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).

11.2 Conference talks

- [T26] 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*.
- [T25] Rodriguez, M., S. H. Bryngelson, and T. Colonius (2022). “Numerical simulations of cavitation near an elastic object”. *ECCOMAS Congress*.
- [T24] Rodriguez, M., J.-S. Spratt, S. H. Bryngelson, and T. Colonius (2022). “Numerical simulations of cavitation bubble growth and collapse near a viscoelastic object”. *19th U.S. National Congress on Theoretical and Applied Mechanics*.
- [T23] Bryngelson, S. H., A. Charalampopoulos, R. O. Fox, T. Sapsis, and T. Colonius (2021). “Bypassing quadrature moment method instability via recurrent neural networks with application to cavitating bubble dispersions”. *American Physical Society*. URL: <https://vimeo.com/650700675/06006b48de>.
- [T22] Bryngelson, S. H., A. Charalampopoulos, T. Sapsis, and T. Colonius (2021). “Machine learned model for non-Gaussian cavitation statistics”. *International Association for Computational Mechanics MMLDT-CSET*.
- [T21] Bryngelson, S. H. and T. Colonius (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. and T. Colonius (2021). “Sub-grid population balance model for cavitating flows”. *14th Southern California Flow Physics Symposium*.
- [T19] Bryngelson, S. H., Q. Wang, E. Cisneros-Garibay, and T. Colonius (2021). “GPU-accelerated quadrature moment methods”. *SIAM Annual Meeting*.
- [T18] Rodriguez, M., S. H. Bryngelson, and T. Colonius (2021). “Acoustically induced bubble growth with phase change”. *14th Southern California Flow Physics Symposium*.
- [T17] Rodriguez, M., S. H. Bryngelson, and T. Colonius (2021). “Vapor and gas bubble growth with phase transition near a wall”. *American Physical Society*.
- [T16] Spratt, J.-S., M. Rodriguez, S. H. Bryngelson, S. Cao, and T. Colonius (2021). “High fidelity single framework simulations of acoustic wave–bubble cloud–elastic solid interactions”. *American Physical Society*.
- [T15] Spratt, J.-S., M. Rodriguez, S. H. Bryngelson, S. Cao, and T. Colonius (2021). “Numerical Simulations of burst-wave lithotripsy in an Eulerian framework”. *14th Southern California Flow Physics Symposium*.
- [T14] Spratt, J.-S., M. Rodriguez, S. H. Bryngelson, S. Cao, and T. Colonius (2021). “Single-framework simulations of acoustic-wave–bubble cloud–stone interactions”. *Journal of the Acoustical Society of America*.

- [T13] Bryngelson, S. H., R. Fox, and T. Colonius (2020). “Conditioned quadrature moment methods for cavitating bubble dispersions”. *American Physical Society*. URL: <https://vimeo.com/640933407/2830cf3e0>.
- [T12] Rodriguez, M., S. H. Bryngelson, and T. Colonius (2020). “Cavitation bubble growth with phase transition near a rigid wall”. *American Physical Society*.
- [T11] Spratt, J.-S., M. Rodriguez, S. H. Bryngelson, and T. Colonius (2020). “A fully Eulerian simulation framework for cavitating bubble-clouds near viscoelastic materials”. *American Physical Society*.
- [T10] Bryngelson, S. H., A. Charalampopoulos, T. P. Sapsis, and T. Colonius (2019). “Neural-network-augmented Gaussian moment method for the statistics of cavitating bubble populations”. *American Physical Society*.
- [T9] Bryngelson, S. H. and T. Colonius (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. and T. Colonius (2019). “Simulations and acoustics of humpback whale bubble-net feeding”. *13th Southern California Flow Physics Symposium*.
- [T7] Trummler, T., K. Schmidmayer, S. H. Bryngelson, and T. Colonius (2019). “Simulations of a collapsing gas bubble above a crevice”. *13th Southern California Flow Physics Symposium*.
- [T6] Bryngelson, S. H. and T. Colonius (2018). “Modeling approaches for bubbly, cavitating flows”. *American Physical Society*.
- [T5] Bryngelson, S. H. and J. B. Freund (2017). “Floquet stability of tank-treading and tumbling capsules in viscous shear flow”. *American Physical Society*.
- [T4] Bryngelson, S. H. and J. B. Freund (2017). “Global stability of fully coupled capsule flow systems”. *SIAM Computational Science and Engineering*.
- [T3] Bryngelson, S. H. and J. B. Freund (2017). “Stability of flowing red blood cell trains”. *Blood Flow*.
- [T2] Bryngelson, S. H. and J. B. Freund (2016). “Stability and transition to chaos of regular capsule trains”. *American Physical Society*.
- [T1] Bryngelson, S. H. and J. B. Freund (2015). “Buckling and its effect on the confined flow of a capsule suspension”. *American Physical Society*.

12 Software

- [S5] Bryngelson, S. H., E. Cisneros-Garibay, Q. Wang, R. O. Fox, and T. Colonius (2020). *PyQBMMlib: A library of quadrature-based moment methods*. URL: <https://github.com/comp-physics/PyQBMMlib>.
- [S4] Bryngelson, S. H., R. O. Fox, and T. Colonius (2020). *QBMMlib: A library of quadrature-based moment methods*. URL: <https://github.com/comp-physics/QBMMlib>.
- [S3] Bryngelson, S. H., A. Radhakrishnan, H. Le Berre, M. Rodriguez, J.-S. Spratt, K. Schmidmayer, V. Coralic, K. Maeda, J. Meng, and T. Colonius (2019). *MFC: Multi-component Flow Code*. URL: <https://mflowcode.github.io>.
- [S2] Schmidmayer, K., B. Dorschner, E. Daniel, S. Le Martelot, S. H. Bryngelson, and F. Petitpas (2019). *ECOGEN: Multiphase and capillary flow solver*. URL: <https://code-mphi.github.io/ECOGEN/>.
- [S1] Campbell, M., E. Cisneros, S. H. Bryngelson, D. Buchta, M. Anderson, M. Diener, and M. Smith (2018). *PlasCom2: Multi-physics turbulent flows*. URL: <https://xpacc-dev.bitbucket.io/PlasCom2/>.