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September 2025 CoMFRE Newsletter

Message from the Director

We are once again surrounded by the multiphase flows of fall, from raking leaves and dumping candy into your Halloween bowl to rain turning to snow and the many mornings with a layer of fog in the air. Campus life has returned to the rhythm of classes, meetings, and research. There have also been some transitions with Dr. Rodney Fox retiring from ISU, and Dr. Mark Mba Wright taking on a leadership role in the ISU Bioeconomy Institute.

We will not have an annual meeting this year but will still organize our annual CoMFRE student poster competition (October 29, 2-4 pm, Howe Hall Atrium). Students should contact Dr. Jaime Juarez ASAP if you plan to present a poster. We hope to see all of you in attendance!

Enjoy the fall weather and activities!

Theodore (Ted) J. Heindel
Director, Center for Multiphase Flow Research and Education
University Professor and Bergles Professor of Thermal Sciences

CoMFRE student poster competition

The CoMFRE student poster competition will be held on **October 28, 2025**, in place of an annual meeting. Students should contact Dr. Jaime Juarez no later than **Friday, Oct. 3 if they plan to present a poster** (the deadline was extended), and then submit a PDF of their poster to Dr. Juarez by Friday, Oct. 10. Then please join us on Oct. 28 in the **Howe Hall Atrium from 2:00 – 4:00 pm** and help support the students and learn more about projects being researched in multiphase flows.

Retirement

Rodney Fox, the Anson Marston Distinguished Professor in Engineering and Hershel B. Whitney Professor, Global Initiatives in the Department of Chemical and Biological Engineering, retired from Iowa State University in August. Rodney has had a distinguished career in reacting and multiphase flow modeling. He has made an impact around the world with several international recognitions and collaborations. We wish him well as he can now spend more time in France.

Appointment

Mark Mba-Wright - Mechanical Engineering, associate director in the Bioeconomy Institute

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CoMFRE and CoMFRE Affiliates in the News

Bridging the gap between innovation and impact

Professor of mechanical engineering and newly appointed associate director of the Bioeconomy Institute, **Mark Mba-Wright** leads research that spans a wide range of technologies, some of which, at first glance, might seem unrelated. His team works on everything from bio-manufactured aviation fuels to synthetic fibers made from environmentally friendly resources to electrochemical systems that use renewable energy to produce fuels and chemicals. Read the full article HERE.

Abusing batteries, collecting data

Todd Kingston, with the help of a federal grant, has equipped his lab with a unique instrument that allows him to test battery safety and performance. Yes, he said, "This allows us to safely blow up batteries." See more HERE.

ISU researchers find one solution for two issues

Mark Mba-Wright is working on injecting carbon-rich bio-oil into the deep shafts of abandoned crude oil wells, which could be an economically feasible system of removing carbon dioxide from the air for long-term storage. Read more HERE

Researchers modeling electrochemical processes to improve energy, critical technologies

Iowa State engineers: **Baskar Ganapathysubramanian** and **Adarsh Krishnamurthy** are joining researchers from across the country to develop new tools to simulate electrochemical processes critical to energy, health care and manufacturing. The U.S. National Science Foundation is supporting the project. The full article is found HERE

Faculty Honors and Awards

CoMFRE member earns U.S. Association for Computational Mechanics Fellows Award

Ming-Chen Hsu has earned the U.S. Association for Computation Mechanics Fellows Award. The Fellows Award recognizes individuals with a distinguished record of research, accomplishments, and publications in the field of computational mechanics, as well as demonstrated support of the U.S. Association for Computational Mechanics (USACM). Multiple awards may be given at two-year intervals. Learn more about the award HERE

Recent Journal Publications

Note that CoMFRE affiliates are identified by **bold** names

- Datar, S., Kaundinya, P., Weibel, J.A., Garimella, S. V., and **Kingston, T. A**., "Correlating Liquid Film Thickness in Microchannel Slug Flow to Bubble Length and Velocity," International Journal of Multiphase Flow (2025): 105367. https://www.sciencedirect.com/science/article/abs/pii/S0301932225002459.

- Gamdha, D., Saurabh, K., **Ganapathysubramanian, B., Krishnamurthy, A**.; “High-resolution thermal simulation framework for extrusion-based additive manufacturing of complex geometries,” Finite Elements in Analysis & Design, 251(104410):1–19, 2025. https://doi.org/10.1016/j.finel.2025.104410

- Karki, S., Shadkhah, M., Yang, C-H., Balu, A., Scovazzi, G., **Krishnamurthy, A**., **Ganapathysubramanian, B**.; “Direct flow simulations with implicit neural representation of complex geometry,” Computer Methods, 446(118248):1–20, 2025. https://doi.org/10.1016/j.cma.2025.118248

- Mishra, A. K., Goh, S. Y., **Ganapathysubramanian, B.**, **Krishnamurthy, A.**; “Real-time 3D reconstruction for enhanced cybersecurity of additive

manufacturing processes," Journal of Manufacturing Processes, 145:274–285, 2025. https://doi.org/10.1016/j.jmapro.2025.04.004

- Saraeian, M., Corpuz, A., **Hsu, M-C**., **Krishnamurthy, A**.; "ParaValve: An open source framework for parametric design and fluid-structure interaction simulation of bioprosthetic valves in patient-specific aortic geometries," Computer-Aided Geometric Design, 120(102455), 2025. https://doi.org/10.1016/j.cagd.2025.102455

- Shadkhah, M., Tali, R., Rabeh, A., Yang, C-H., Herron, E., Upadhyaya, A., **Krishnamurthy, A**., Hegde, C., Aditya Balu, A., **Ganapathysubramanian, B**.; "MPFBench: A large scale dataset for SciML of multi-phase-flows: droplet and bubble dynamics," Journal of Data-centric Machine Learning Research, 2025. https://openreview.net/group?id=DMLR#tab-accepted-papers

- Tali, R., Rabeh, A., Yang, C-H, Shadkhah, M., Karki, S., Abhisek Upadhyaya, Dhakshinamoorthy, S., Saadati, M., Sarkar, S., **Krishnamurthy, A**., Hegde, C., Balu, A., **Ganapathysubramanian, B**.; "FlowBench: A large scale benchmark for flow simulation over complex geometries," Journal of Data-centric Machine Learning Research, 2025. https://openreview.net/group?id=DMLR#tab-accepted-papers

- Yang, C-H., Scovazzi, G., **Krishnamurthy, A**., **Ganapathysubramanian, B**.; "Octree-based adaptive mesh refinement and the shifted boundary method for efficient fluid dynamics simulations," Advances in Computational Science and Engineering, 4:57–84, 2025. https://www.aimsciences.org//article/doi/10.3934/acse.2025012

Recent Conference Publications and Presentations

Note that CoMFRE affiliates are identified by **bold** names

- Al-Subaey, M.Y., **Passalacqua, A**., and **Heindel, T.J.** "Using XCT to Quantify Air Entrainment at the Gas-Liquid Interface of a Stirred Tank Reactor," ASME 2025 Fluids Engineering Division Summer Meeting, Philadelphia, PA, July 27-30, 2025, Abstract FEDSM2025-169667.

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