June 2024 CoMFRE Newsletter

Message from the Director

Summer is upon us, and the rhythm of campus has changed. It went from students scurrying between class to new student orientation and various groups using campus facilities. The pace has slowed but there is still much activity behind the various laboratory doors. Graduate students are working diligently on their projects and a few students are taking summer classes at an accelerated pace. Faculty and their students are also attending conferences to present their work.

Multiphase flows are also part of the summer season. It is raining as I write this, which is a great example of an environmental multiphase flow. They are also found in our community swimming pools, on sandy beaches, and the fireworks of 4th of July.

Enjoy your summer and the multiphase flows associated with it!

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

2024 CoMFRE Annual Meeting

The 2023 CoMFRE Annual Meeting will take place on October 21-22, 2024 at the Iowa State Alumni Center. Confirmed speakers include representatives from AFRL Reginal Network-Midwest and BioMADE. Additional speakers are being confirmed. Talk to your students about presenting a poster at our annual poster competition and mark your calendar to attend. More information to follow.

New CoMFRE Leadership Team Member

Every year, the composition of our CoMFRE Leadership Team changes. CoMFRE is organized into a 6-member leadership team, where 3 members are permanent, and 3 serve rotating 3-year terms. The current leadership team includes Ted Heindel (Director), Alberto Passalacqua (Associate Director), and Rodney Fox (Executive Director) as the three permanent members, and rotating members Nicole Hashemi (finishing her 3rd year), James Michael (finishing his 2nd year), and Mehari Tekeste (finishing his 1st year).

Nicole Hashemi is rotating off the leadership team, and James Michael recently left ISU for other opportunities. We thank them both for their valuable contributions.

Jaime Juarez, Associate Professor of ME, and Todd Kingston, Assistant Professor of ME, were selected by CoMFRE faculty members to be the newest members of the CoMFRE Leadership Team. Jaime and Todd, welcome to our team!

New CoMFRE Faculty

Qiang Zhong is an Assistant Professor in the Department of Mechanical Engineering with expertise in experimental fluid mechanics and robotics, focusing on research related to unsteady fluids in bioinspired propulsion, energy harvesting, and perception, particularly with an interest in the effects of free-surface phenomena on the wake dynamics of submerged and partially submerged unsteady bodies.

Saikat Mukherhee is an Assistant Professor in the Department of Mechanical Engineering that has an interest in the numerical modeling of biological fluid dynamics and transport processes with current emphasis on cerebrospinal fluid (CSF) flow, flows involving bacteria and biofilms, and autocatalytic reaction fronts. Multiphase flows are intrinsic to these problems; for instance, waste protein and ionic transport in the CSF and swimming bacteria in the small intestine are causative mechanisms behind Alzheimer's disease, Parkinson's, epilepsy, reflux, and gut-motility disorders.

CoMFRE and CoMFRE Affiliates in the News

CoMFRE affiliate travels to India to deliver invited lecture

CoMFRE's founding director, **Shankar Subramaniam**, delivered an invited lecture at the 2024 International Union of Theoretical and Applied Mechanics. "Fostering international collaboration in the area of multiphase flows is important to accelerate our understanding, prediction, and control of multiphase

flows in these applications, and to encourage the next generation of researchers in this important technical area," says Subramaniam. Read More

CoMFRE affiliate has research featured

Nicole Hashemi, Associate Professor of M.E., has had her recent three-year NSF Mid-Career Advancement grant research featured in *STAT*. Please read the full article here

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Faculty Honors and Awards

- **Hui Hu**, professor, aerospace engineering; and Martin C. Jischke Professor in Aerospace Engineering was awarded the title of Distinguished Professor.
- **Ming-Chen Hsu**, promoted to Professor of Mechanical Engineering.
- **Chris Rehmann**, promoted to Professor of Civil, Construction, and Environmental Engineering.
- **Jonghyun Lee**, promoted to Associate Professor of Mechanical Engineering (with tenure).

Recent Funded Research Awards

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

- "Understanding buoyant-particle- induced heat and mass transfer through integrated experiments and simulations", **A. Passalacqua** (PI), **Hui Hu**, **Shankar Subramaniam**, **Rodney O. Fox**, NSF, $554,075.

Recent Journal Publications

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

- Ahasan, K., Schnoebelen, N.J., Shrotriya, P., and **Kingston, T.A.**, "Continuous sampling of aerosolized particles using stratified two-phase microfluidics," ACS Sensors (*recently accepted; volume and page numbers not yet available*). https://doi.org/10.1021/acssensors.4c00042
- Chen, X., Xiang, Z., Zhong, W, and **Heindel, T.J.,** "An XCT study on three-dimensional characteristics of a spout-fluid bed," *Chemical Engineering Science*, 295, Paper 120049. https://doi.org/10.1016/j.ces.2024.120049

Recent Conference Publications and Presentations

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

- De Penning, S., Schnoebelen, N.J., Ahasan, K., Murphy, M.P., Nilsen-Hamilton, M., **Kingston, T.A**., and **Shrotriya, P**., Biosensing platform for integration with a microfluidic capture device, SPIE Defense + Commercial Sensing – Chemical, Biological, Radiological, Nuclear, and Explosive (CBRNE) Sensing XXV Conference, National Harbor, MD, 2024. https://www.spiedigitallibrary.org/conference-proceedings-of-spie/13056/130560I/Condensation-based-growth-of-nanoparticles-for-real-time-inertial-based/10.1117/12.3013950.full
- **Heindel, T.J**., "X-ray Flow Visualization: Techniques and Applications for Multiphase Flows," Invited keynote presented at the *American Society of Nondestructive Testing: Advanced Imaging for NDT Conference*, Cincinnati, OH, April 16-18, 2024.
- **Heindel, T.J.,** "Visualizing Multiphase Flows with Tube Source X-rays: A Tutorial," Invited tutorial presented at the *American Society of Nondestructive Testing: Research Symposium*, Pittsburgh, PA, June 23-28, 2024.
- Islam, S., Schnoebelen, N.J., Ahasan, K., **Shrotriya, P**., and **Kingston, T.A**., Condensation-based growth of nanoparticles for real-time inertial-based capture and biothreat sensing, SPIE Defense + Commercial Sensing – Chemical, Biological, Radiological, Nuclear, and Explosive (CBRNE) Sensing XXV Conference, National Harbor, MD, 2024 https://www.spiedigitallibrary.org/conference-proceedings-of-spie/13056/130561I/Compact-biosensing-platform-for-integration-with-airborne-particle-capture-device/10.1117/12.3013753.full

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Student Honors and Awards

Awards for Students Working on Multiphase Projects

- Saria Hannan, M.S. student, Research Excellence Award, advised by **Alberto Passalacqua**
- Liujing Wang M.S. student, Department of Aerospace Engineering presented a poster titled "Understanding the role of chain stiffness in conformational behaviors of conjugated polymers". Receiving 5th place at Nano@IAState Meeting in Ames, IA, advised by **Wenjie Xia**

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