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March 2025 CoMFRE Newsletter

Message from the Director

Welcome to our March 2025 CoMFRE Newsletter. The multiphase flows of spring are upon us, from the spreading of granular fertilizer on our lawns to the falling rains that water it in. The spring weather has certainly been a roller coaster, at least in Ames, where one day it was in the 70s and the next day we had a blizzard warning!

We recently finished Spring Break on the ISU campus and CoMFRE faculty are busy trying to fit everything that is needed into their classes before the semester ends. We are also busy with research. The funding landscape has been in turmoil the past few months, but CoMFRE faculty are resilient and are adjusting where we can. We are willing and able to use our multiphase flow expertise to expand fundamental knowledge through federally funded research, as well as assist industry in applied research to solve a specific problem. Feel free to reach out to me if you have a specifc need and I will connect you to the right CoMFRE researcher.

Enjoy the multiphase flows around you!

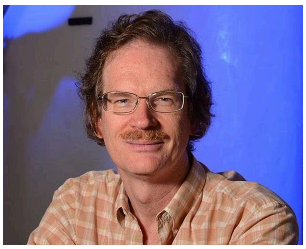
Ted

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

CoMFRE and CoMFRE Affiliates in the News

Rodney Fox honored for ‘Scientific Excellence’

The American Association for the Advancement of Science, one of the world’s largest scientific societies and publisher of the journal Science, announced its



class of 2024 fellows this March. The recognition is considered “a distinguished lifetime honor within the scientific community,” according to the association.

Rodney Fox, Anson Marston Distinguished Professor in Engineering and executive director of the Center for Multiphase Flow Research and Education, “For distinguished contributions applying computational fluid dynamics to chemical reaction engineering.”

In collaboration with researchers at the University of Paris-Saclay and the Ecole Polytechnique in France, Fox is developing innovative hydrodynamic models and computer simulation codes for multiphase reacting flows. Predictive simulations of such flows are essential engineering tools for numerous environmental and industrial applications. Full story can be found HERE.

Nicole Hashemi named NAI Senior Member

Nicole Hashemi, associate professor of mechanical engineering and CoMFRE affiliate faculty member, has been named to the 2025 class of National Academy of Inventors Senior Members.

The honor recognizes the nation’s top emerging leaders in turning innovative discoveries into new technologies and products. Hashemi is an international leader in the field of bioinspired materials processing.

Zengyi Shao receives White House PECASE award

Zengyi Shao, the Hershel B. Whitney Professor, Global Initiatives in Chemical and Biological Engineering and CoMFRE affiliate faculty member, was honored with the Presidential Early Career Award for Scientists and Engineers, one of the government’s highest recognitions.

Shao research group focuses on functional genomics of high-performing microbial species possessing distinctive biochemical and biomedical potentials. Leveraging these rapidly proliferating testbeds, the group aspires to unravel essential cellular processes and unveil fundamental mechanisms employing synthetic biology strategies.

Kejin Wang mentoring tomorrow’s 3D concrete printing innovators

In lab, undergraduate researchers like Ben Johnson are getting hands-on experience advancing the field of 3D-printed concrete structures.

“Dr. Wang provided me with guidance and mentorship as I learned how to

analyze and collect data," says Johnson, a construction engineering major. "The research process, the planning, analysis, finding new ways to efficiently accomplish a goal, are all skills I can use outside of the lab too."

Kejin Wang is an Anson Marston Distinguished Professor of Engineering, Wilson Professor of Engineering, and CoMFRE affiliate faculty member. Read more HERE.

Recent Funded Research Awards

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

- "X-ray Flow Visualization of a Gas Jet Impinging on a Dense Granular Bed", **T.J. Heindel** (PI), **AFRL Regional Network – Midwest**, $200,000.

Recent Journal Publications

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

- Ouedraogo, L.J.G, Kling, M., and **Hashemi, N.N**., "Graphene Microelectrodes for Real-Time Impedance Spectroscopy of Neural Cells in Organ-on-a-chip," *APL Materials*, 13, 02113, 2025. https://doi.org/10.1063/5.0252728.
- Xiang, Z., Chen, X., and **Heindel, T.J.**, "Investigating Gas-Solid Flow Hydrodynamics in Spouted Beds with a Draft Tube Using XCT: The Role of Tube Types, Gas Velocity, and Diameter," *Powder Technology*, 456, Paper 120850, 2025. https://doi.org/10.1016/j.powtec.2025.120850.
- Naidu S., Pandey H., **Passalacqua, A**., Hameed, S., Joshi, J., Sharma, A., "Advancements in modeling and simulation of biomass pyrolysis: A comprehensive review," *Journal of Analytical and Applied Pyrolysis* 188 107030 (2025) https://doi.org/10.1016/j.jaap.2025.107030.

Recent Conference Publications and Presentations

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

- **Passalacqua, A**., Vasquez Giuliano L., **Fox, R.O.,** "Recent Advances in Euler-Euler Modeling of Multiphase Polydisperse Flows with Quadrature-Based Moment Methods," SIAM Conference on Computational Science and Engineering, Mini symposium MS119 "Computational Advances in Modeling of Dispersed Multiphase Flows", Fort Worth, Texas, March 3rd – 7th, 2025.
- **Mukherjee, S**., "Continuum Modeling of Transport and Microbial Dynamics in an Idealized Intestinal Geometry" APS Global Physics

Summit, “Microbial Communities II” Anaheim, CA March 16-21, 2025

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