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June 2022 CoMFRE Newsletter

Message from the Director

Summer is officially here. I hope you are enjoying the multiphase flows you may find at this time of year, from splashing at the pool to hitting a golf ball out of a sand trap to drinking your favorite beverage under the shade of a tree. Campus has a much slower pace at this time of year. However, we at CoMFRE are busy planning for the fall semester, which includes our in-person annual meeting on October 24-25, 2022. Details of this event will be made available once the agenda is finalized.

We are also pleased to announce that Cindy Ross has joined CoMFRE as the main ISU staff contact; she is introduced below.

Enjoy the summer, and we look forward to seeing you in Ames in the fall.



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



2022 CoMFRE Annual Meeting

The 2022 CoMFRE Annual Meeting will take place on October 24-25, 2022. The current plan is for an in-person meeting with live presentations and a live student poster competition. More details will follow, but please put a hold on your calendar.

New CoMFRE Support Staff

Cindy Ross

Program Specialist I - Engineering Research Institute & Center of Multiphase Flow Research and Education



Cindy Ross is the new Program Specialist working with both the Engineering Research Institute (ERI) and the Center for Multiphase Flow Research and Education (CoMFRE). In her new role, she will be providing grant and award assistance, primarily for CoMFRE. She will also be providing CoMFRE communication, publishing the CoMFRE quarterly newsletters, updating the CoMFRE webpage, and managing

CoMFRE membership accounts. She can be contacted at cynthiar@iastate.edu

A full list of CoMFRE faculty can be found [here](#)

CoMFRE and CoMFRE Affiliates in the News

Soft, porous microelectrodes to better understand TBI mechanisms

CoMFRE affiliate **Nicole Hashemi** and her collaborator Reza Montazami, both associate professors of mechanical engineering, are studying how the mechanical forces affect traumatic brain injuries (TBI), as a crucial first step to developing treatments for TBI or designing equipment to protect against injury. In the Office of Naval Research funded project, the research team will use a novel microfluidic approach utilizing aqueous graphene suspensions as an electrically conductive ink to create a soft and porous microelectrode array for monitoring the extracellular activities of neural cells. The full story can be found [here](#).

New CoMFRE project to improve droplet breakup models

A CoMFRE team is investigating how turbulence intensity and fluid properties impact droplet breakup. Led by CoMFRE affiliate **Michael Olsen**, the team will inject droplets into a flow chamber with a uniform turbulent field and take high-speed videos of the droplet as it is deformed and broken by turbulence.

<https://news.engineering.iastate.edu/2022/06/20/new-comfre-project-to-improve-droplet-breakup-models/>

Faculty Honors and Awards

- **Fulbright-Tocqueville Distinguished Chair Award**
Rodney Fox, executive director of CoMFRE, Anson Marston Distinguished Professor in Engineering and Hershel B. Whitney Professor, Global Initiatives, has been selected for the 2022-23 Fulbright-Tocqueville Distinguished Chair Award. The program is part of the Fulbright Franco-American Commission for Educational Exchange, and Fox will be a visiting professor at the Laboratoire EM2C, CentraleSupélec, Gif-sur-Yvette, France. More can be found [here](#).

- **ISU Interdisciplinary Team Research Award**

Mark Mba-Wright, CoMFRE affiliate and associate professor of mechanical engineering, is part of the C-CHANGE (Consortium for Cultivating Human And Naturally reGenerative Enterprises) team, who received the ISU Interdisciplinary Team Research Award. The award recognizes an interdisciplinary team of two or more faculty researchers with outstanding achievements who have made a significant contribution to the university's research and scholarship mission through successful interdisciplinary collaborations.

CoMFRE Affiliates Promoted to Associate Profesor with Tenure:

- James Michael, Mechanical Engineering
 - Mehari Tekeste, Agricultural and Biosystems Engineering
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Student Honors and Awards

Recent Degrees Granted to Students Working on Multiphase Projects

- Viraj V. Belekar, PhD, Dissertation title: “Modeling and simulation of hydrodynamics, heat and mass transfer of wet granular mixtures in agitated filter-dryers,” Advisor: **Shankar Subramaniam**. (Viraj was funded by a CoMFRE project.)
 - Menglin Ni, MS, “Residual Term of the Volume-Filtered Multiphase Flow Momentum Equation,” Advisor: **Shankar Subramaniam**.
 - Jiazhong Zhou, MS, “Developing Models for Gas-Solid Heat Transfer Using Particle-Resolved Direct Numerical Simulation,” Advisor: **Shankar Subramaniam**.
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Recently Funded Research Awards

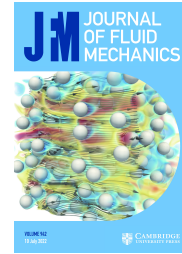
Feel free to contact the PI directly if you have any questions on the projects below.

- "Predictive Tools and Experiments for Blood Backspatter: Incorporating Tissue Simulants and Muzzle Gas Interactions,” **James Michael**, DOJ – National Institute of Justice; New Funding Amount: \$713,519.
 - “Broadband Laser Diagnostic Probe for Detonation Environments” **James Michael** Funding Agency: DOD-Defense Threat Reduction Agency (DTRA); New Funding Amount: \$314,999.
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Recent Journal Publications

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

- **Fox, R.O.** and Laurent, F., "Hyperbolic Quadrature Method of Moments for the One-Dimensional Kinetic Equation," SIAM Journal of Applied Mathematics 82 (2), 750-771 (2022).
- Lattanzi, A., Tavanashad, V., **Subramaniam, S.** and Capecelatro, J. "Fluid-Mediated Sources of Granular Temperature at Finite Reynolds numbers," Journal of Fluid Mechanics.942, A7 2022. *Selected for cover art:*
- Ravichandar, K., **Vigil, R.D., Fox, R.O.,** Nachtigall, S., Daiss, A., Vonka, M., and **Olsen, M.G.**, "Turbulent Droplet Breakage in a Von Karmen Flow Cell," Physics of Fluids (accepted).
- Zhang, S., Zhang, Q., Kong, B., **Fox, R.O.,** and Yang, C., "An Effectiveness Factor Model for Predicting Product Properties in Slurry Phase Olefin Polymerization Reaction," Chemical Engineering Science 251, 117429 (2022).



Recent Conference Publications and Presentations

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

- Alméras, E., Risso, F., Masbernat, O., and **Fox, R.O.**, "Statistics of Velocity Fluctuations in a Finite Reynolds-Number Concentrated Fluidized Suspension," IUTAM Symposium: From Stokesian Suspension Dynamics to Particulate Flows in Turbulence, Toulouse, France.
- Dahlstrom, T.C., Morgan, T.B., Kastengren, A.L., and **Heindel, T.J.**, "White Beam Visualization of an Airblast Atomizer Under Various Ambient Pressures," ILASS Americas 2022, Madison, WI, May 22-25, 2022, Paper Number: 14.
- Ilgun, A., **Fox, R.O.**, and **Passalacqua, A.**, "Computational Methods for Turbulent Reacting Flows in the Limit of High Schmidt Number," 19th U.S. National Congress on Theoretical and Applied Mechanics, Austin, TX.
- Peng, C., Capecelatro, J., Lattanzi, A., and **Fox, R.O.**, "The Effect of Fluid-Mediated Particle-Particle Forces in Liquid-Solid Sedimentation," Turbulence and Interactions, Procchio, Elba, Italy.
- Posey, J. W., Houim, R.W., and **Fox, R.O.**, "Development of an Eulerian Polydisperse Multiphase Flow Model," Florida Fluids Symposium, Tallahassee, FL.
- Ray, M., **Passalacqua, A.**, and **Fox, R.O.**, "CFD Simulation of Bubble Coalescence and its Effect on Current Density and Gas Production in Electrolysers," 33rd International Conference on Parallel Computational Fluid Dynamics, Alba, Italy.

Recent Invited Talks

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

- **Fox, R.O.**, “Twenty Years of Quadrature-Based Moment Methods: What have we learned?” Keynote Lecture, 7th International Conference on Population Balance Modelling (PBM 2022), Lyon, France
- **Fox, R.O.**, “Droplet Breakup in Isotropic Turbulence”, Invited Lecture, ERCOFTAC Workshop on Turbulence and Interface, Lyon, France
- **Fox, R.O.**, “Computational Methods for Turbulent Reacting Flows in the Limit of High Schmidt Number,” Invited Lecture, USNC/TAM 2022, Austin, TX.
- **Fox, R.O.**, “Role of the Particle-Fluid-Particle Pressure Tensor in Gas-Liquid and Liquid-Solid Flows,” Invited Lecture, Fluid Dynamics Seminar, CEA Saclay, France.
- **Fox, R.O.**, “Hyperbolic Quadrature Method of Moments for Kinetic-Based Flow Models”, Invited Lecture, 2022 SIAM Annual Meeting, Pittsburgh, PA.
- **Fox, R.O.**, “From Close-Packed to Dilute Conditions: Well-Posed Eulerian Two-Fluid Models for High-Speed Polydisperse Fluid–Particle Flows”, Plenary Lecture, 4th International Conference on Numerical Methods for Multiphase Flows (ICNMMF-4), Venice, Italy.
- **Fox, R.O.**, “Gas-solid Flow Models Based on the Kinetic Theory of Granular Flows: What Have We Learned Since MFIx Version 1?”, Invited Talk in Honor of Madhava Syamlal, AIChE Annual Meeting, Phoenix, AZ.

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