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IOWA STATE UNIVERSITY

Center for Multiphase Flow Research and Education

March 2020 CoMFRE Newsletter

Message from the Director

The world certainly has changed since our December 2019 newsletter. Everyone knows the meaning of self-isolation, social-distancing, and COVID-19. Our education and work locations have also changed. Iowa State's spring semester changed from in-person to on-line on March 23 (after a week of spring break). We will not have students on campus until mid-summer at the earliest, and our traditional graduation ceremony has been cancelled. Our research enterprise has also changed where we are encouraged to work from home. That is much easier to do for computational researchers, and more difficult for an experimentalist who needs experimental measurements to complete their work. Many students and faculty are now doing a lot of writing, and I foresee a large number of papers and proposals that will be submitted over the next 3 months.

Wherever you may be, I hope you and your family are healthy and safe.

With kind regards,



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



Updated CoMFRE Website

We have been working over the past few months to update our website. Our CoMFRE web address (<https://comfre.iastate.edu/>) now contains the updated content. Please check it out and let us know what you think.

CoMFRE and CoMFRE Affiliates in the News

- **A Year in Review: What's New with CoMFRE?** CoMFRE has undergone notable developments over the course of the past year. After becoming an official center in fall 2017, the center continues to grow as collaboration flourishes and research advances.
<https://news.engineering.iastate.edu/2020/02/26/whats-new-with-comfre/>
- **Examining Sprays with X-rays and High-Speed Imaging:** Researchers in Ted Heindel's Experimental Multiphase Flow Lab are using X-rays and high-speed imaging to experimentally study the near-field spray region where spray formation occurs as part of an Office of Naval Research project. A collaborating researcher from the University of Illinois Urbana-Champaign, another site for the project, recently visited campus to take advantage of the state-of-the-art resources available at Iowa State.
<https://news.engineering.iastate.edu/2020/02/12/using-x-rays-and-high-speed-imaging-to-examine-sprays/>
- **Model to improve steel manufacturing – by way of the International Space Station:** Jonghyun Lee, assistant professor of mechanical engineering and CoMFRE faculty member, is leading a multiyear, \$750,000 project titled Modeling and Simulations of Electrostatically Levitated Multiphase Liquid Drops.
<https://news.engineering.iastate.edu/2020/02/11/model-to-improve-steel-manufacturing-by-way-of-the-international-space-station/>
- **Collaboration with AbbVie brings value to CoMFRE:** Graduate students reap benefits from their work with member company AbbVie.
<https://news.engineering.iastate.edu/2020/03/11/collaboration-with-abbvie-brings-value-to-comfre/>

New CoMFRE Faculty Affiliate

This month we welcomed Junxing (Jun) Zheng, Assistant Professor in Civil, Construction and Environmental Engineering, as a new CoMFRE affiliate. His research focus is in the area of particulate materials where he uses advanced computer vision, machine learning, programming, sensor technologies, and numerical/physical modeling to study applications related to geotechnical/materials engineering.

A full list of CoMFRE faculty affiliates can be found here:

<https://comfre.iastate.edu/faculty-2-2/page/1/>

Student Awards

- Bharath Melugiri Shankaramurthy: Iowa Ready Mixed Concrete Associations' 2020 Scholarship (\$2,500), IRMCA Dinner Meeting, March 3, 2020; Advisor: Kejin **Wang**
 - Bharath Melugiri Shankaramurthy: James K Cable Portland Cement Concrete Overlay Scholarship (\$1,000), Feb. 2020; Advisor: Kejin **Wang**
 - Yogiraj Sargam: James K Cable Portland Cement Concrete Overlay Scholarship (\$1,000), Feb. 2020; Advisor: Kejin **Wang**
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Recently Funded Awards

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

- "Autothermal Pyrolysis of Western Red Cedar for Dispatchable Renewable Power", Robert C. Brown and **Mark Mba-Wright**; Funding Agency: Nebraska Public Power District; New Funding Amount: \$22,839.
 - "Testing of Durable Elastomeric and Metal Based Icephobic Coatings for Turbomachinery Ice Protection Applications", **Hui Hu**; Funding Source: Industry; New Funding Amount: \$25,832.
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- “End-to-end Pipeline for Multi-sensor Data Collection with the Toyota Avalon”; **Soumik Sarkar**, Anuj Sharma and Shauna L. Hallmark; Funding Source: Industry; New Funding Amount: \$29,321.
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Recent Journal Publications

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

- J.K. Bothell, N. Machicoane, D. Li, T.B. Morgan, A. Aliseda, A.L. Kastengren, and T.J. **Heindel**, “Comparison of X-ray and optical measurements in the near-field of an optically dense coaxial air-assisted atomizer”, International Journal of Multiphase Flow, 2020, Vol. 125, Paper 103219, <https://doi.org/10.1016/j.ijmultiphaseflow.2020.103219>
 - A. Chausalkar, C-B. M. Kweon, S-C. **Kong**, and J.B. **Michael**, "Leidenfrost behavior in drop-wall impacts at combustor-relevant ambient pressures", International Journal of Heat and Mass Transfer, 2020, 153, 119571. <https://doi.org/10.1016/j.ijheatmasstransfer.2020.119571>
 - W. Dong, W. Li, K. Vessalas and K. **Wang**, “Mechanical and conductive properties of smart cementitious composites with conductive rubber crumbs”, ES Materials & Manufacturing, 2020, 7, DOI: 10.30919/esmm5f711
 - B. Kong and R. O. **Fox**, “A moment-based kinetic theory model for polydisperse gas-particle flows”, Powder Technology, 2020, 365, 92-105.
 - G. Li, J. Zhou, J. Yue, X. Gao, and K. **Wang**, “Effects of nano-SiO₂ and secondary water curing on the carbonation and chloride resistance of autoclaved concrete”, Construction & Building Materials, 2020, 235, 117465
 - J. Liu, K. **Wang**, Q. Zhang, G. Lomboy, L. Zhang, and J. Liu, “Effects of ultrafine powders on the properties of lubrication layer and highly flowable concrete”, ASCE J. of CE Materials, 32:5, May 2020, <https://ascelibrary.org/doi/10.1061/%28ASCE%29MT.1943-5533.0003193>
 - N. Panicker, A. **Passalacqua**, and R.O. **Fox**, “Computational study of buoyancy driven turbulence in statistically homogeneous bubbly flows”, Chemical Engineering Science, 2020, 216, 115546. <https://doi.org/10.1016/j.ces.2020.115546>
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- A. **Passalacqua**, F. Laurent, and R. O. **Fox**, “A second-order realizable scheme for moment advection on unstructured grids”, Computer Physics Communications, 2020, 248, 106993.
- H. Qin, K. Manikandan GD, K. Wi, X. Zhang, and K. **Wang**, “Characterizing cement mixtures for concrete 3D printing”, Manufacturing Letters, Accepted 3/4/2020
- M. Ray, F. Chowdhury, A. Sowinski, P. Mehrani, A. **Passalacqua**, “Eulerian modeling of charge transport in bi-disperse particulate flows due to triboelectrification”, Physics of Fluids, 2020, 32, 023302.
<https://aip.scitation.org/doi/10.1063/1.5140473>
- Y. Sargam, K. **Wang**, and J. Alleman, “Effects of modern concrete materials on thermal conductivity”, ASCE J. of Civil Engineering Materials, 2020, 32(2), <https://ascelibrary.org/doi/10.1061/%28ASCE%29MT.1943-5533.0003026>
- G. Shallcross, R. O. **Fox**, and J. Capecelatro, “A volume-filtered description of compressible particle-laden flows”, International Journal of Multiphase Flows, **2020**, 122, 103138.
- K. Wi, V. Suresh, K. **Wang**, B. Li, and H. Qin, “Quantifying quality of 3D printed clay objects using a 3D structured light scanning system”, Additive Manufacturing, 2020, 32, 100987,
<https://doi.org/10.1016/j.addma.2019.100987>
- F. Zhang, J. Xia, G. Li, Z. Guo, H. Chang, and K. **Wang**, “Degradation of axial ultimate load-bearing capacity of circular thin-walled concrete-filled steel tubular stub columns after corrosion”, Materials J. (In press; accepted Feb 6, 2020)

Recent Conference Publications and Presentations

- None this quarter.