2023 NETL Workshop on Multiphase Flow Science

Tuesday, August 1, 2023
All times are Eastern Daylight Time

09:00 – 09:20 AM **Convene, Webex Logistics**
NETL Conference Services

Session Chair – Mary Ann Clarke

9:20 – 09:40 AM **Welcome and Introduction**
Mehrdad Shahnam, National Energy Technology Laboratory

09:40 – 10:00 AM **A particle resolved approach for simulation of freely evolving sphere suspensions**
Ze Cao[1], Danesh. K. Tafti[2], [1]Faculty of Infrastructure Engineering, Dalian University of Technology, Dalian, Liaoning, China 116081, [2]Department of Mechanical Engineering, Virginia Tech, VA 24060

10:00 – 10:20 AM **Numerical study of fluidization of binary mixture of particles using SOM- KTGF-MP**
Dan Sun, National Institute of Clean-and low-carbon Energy, Beijing, China

10:20 – 10:40 AM **CFD-DEM MODELING OF CONICAL SPOUTED BED SOLAR RECEIVERS**
Arif Eren Özdemir[1], Neslin Doğan[2], Görkem Külah[3], Murat Köksal[1], [1]Department of Mechanical Engineering, Hacettepe University, [2]Micro and Nanotechnology Program, Middle East Technical University, [3]Department of Chemical Engineering, Middle East Technical University

10:40 – 10:50 PM **Break**

10:50 – 11:10 PM **UNETs for flow field and drag force predictions in dispersed particle flows**
Neil Ashwin Raj[1], Danesh Tafti[1], Nikhil Muralidhar[2], [1]Dept. of Mechanical Engineering, Virginia Tech, Blacksburg, VA, [2]Department of Computer Science, Stevens Institute of Technology, Hoboken, NJ

11:10 – 11:30 AM **Modelling fluidized dense phase conveying of Geldart A powders with MFiX-TFM: A case study**
Prabu Balasubramanian, Andrew Cowell, Don McGlinchey, School of Computng, Engineering and Built Environment, Glasgow Caledonian University, United Kingdom

11:30 – 11:50 AM **Effects of particle Froude number on the sub-grid behavior of fluidized gas-particle flows**
Christian C. Milioli, Fernando E. Milioli, University of Sao Paulo, Brazil

11:50 – 12:10 PM **Scale sensitive sub-grid models for effective drag, filtered and residual stresses in fluidized gas-particle flows**
Christian C. Milioli, Fernando E. Milioli, University of Sao Paulo, Brazil

Tuesday, August 1, 2023
All times are Eastern Daylight Time

12:10 – 12:40 PM **Break**

Session Chair – William Fullmer

12:40 – 1:00 PM **Development of a High-Temperature Counter-Flow Particle Receiver for Concentrated Solar Power Applications**
Anton Hartner, Filippo Coletti & Aldo Steinfeld, Department of Mechanical and Process Engineering, ETH Zurich, 8092 Zurich, Switzerland

1:00 – 1:20 PM **Enhancing Insight into Granular Flows through Proper Orthogonal Decomposition**
J.E. Higham, Associate Professor, School of Environmental Sciences, University of Liverpool, UK

1:20 – 1:40 PM **Progress towards measuring interfacial phenomena**
Philippe M Bardet, Eirini Florou, Daniel Hunter, Roberto Capanna, Charles Fort, Corentin Le Houedec, Sabine Portal, The George Washington University

1:40 – 2:00 PM **100 years of scaling up fluidized beds**
Jia Wei Chew, Wyatt LaMarche, Ray Cocco, Particulate Solid Research, Inc., Chicago IL 60632

2:00 – 2:20 PM **Collecting Transient Two-phase Flow Data from Periodic Oscillations**
Caleb S. Brooks and Taiyang Zhang, Department of Nuclear, Plasma, and Radiological Engineering, University of Illinois at Urbana-Champaign

2:20 – 2:30 PM **Break**

Session Chair – Janine Carney

2:30 – 2:50 PM **Contact charging in particulate flows**
S. Sundaresan, Princeton University

2:50 – 3:10 PM **Granular and Fluid Instabilities in Explosive Volcanic Eruptions**
Josef Dufek[1], Eric Breard[2], Jordan Musser[3], [1]Center for Volcanology, University of Oregon,[2] School of Geosciences, University of Edinburgh, [3] National Energy Technology Center, Department of Energy

3:10 – 3:30 PM **Computational Modeling of Dilute Two-Phase Flows - Application to Transmission of Respiratory Viruses**
Goodarz Ahmadi, Department of Mechanical and Aerospace Engineering Clarkson University, Potsdam, NY

Tuesday, August 1, 2023
All times are Eastern Daylight Time

3:30 – 3:50 PM **Uncertainty Quantification in Crater Formation for Gas-Granular Flows due to Plume Surface Interaction**
Raymond L. Fontenot, Senior Research Engineer, CFD Research Corporation

3:50 – 4:10 PM **Hybrid MPI-OpenMP Accelerated Eulerian-Lagrangian Modeling of Multiphase Flow with Bio-applications**
Jingsen Ma, Chao-Tsung Hsiao, & Greg Loraine, DYNAFLOW, INC., 10621-J Iron Bridge Road, Jessup, MD

4:10 – 4:30 PM **A Stochastic Approach to Modeling Subgrid Velocity Fluctuations in Large Eddy Simulation of Turbulent Wall-Bounded Particle-Laden Flows**
Farid Rousta[1], Bamdad Lessani[2], and Goodarz Ahmadi[1], [1] Department of Mechanical and Aeronautical Engineering, Clarkson University, Potsdam, NY, [2] Mechanical Engineering and Engineering Science, University of North Carolina at Charlotte, Charlotte, NC

4:30 – 4:50 PM **Proppant Laden Flows in Rock Fractures – Numerical Simulation for Geothermal Applications**
Farid Rousta[1], Goodarz Ahmadi[1], Dustin Crandall[2], [1] Department of Mechanical and Aeronautical Engineering, Clarkson University, Potsdam, NY, [2] National Energy Technology Laboratory, US Department of Energy, Morgantown, WV

4:50 PM **Tuesday Session Ends**

Wednesday, August 2, 2023
All times are Eastern Daylight Time

09:00 – 09:20 AM **Convene, Webex Logistics**
NETL Conference Services

Session Chair – Jordan Musser

09:20 – 09:40 PM **Machine Learning-Based Force Models for Irregular-shaped Particles in Gas-Solid Flows**
Soohwan Hwang, Liang-Shih Fan, William G. Lowrie Department of Chemical and Biomolecular Engineering, The Ohio State University

09:40 – 10:00 AM **Enabling Predictive Simulations of Reacting Multiphase Flows via Data-Driven Emulation**
Roberto Torelli, Senior Research Scientist, Argonne National Laboratory, Transportation and Power Systems Division 9700 S Cass Ave, Lemont, IL

10:00 – 10:20 AM **Numerical analysis of regular material point method and its application to multiphase flows**
Sreejith N. A., Nicholas Deak, Hariswaran Sitaraman, Marc Day, NREL

10:20 – 10:40 PM **Revisiting Wen and Yu: An empirical drag model based on the foundational data sets of fluidizations**
James Parker, CPFD Software

10:40 – 10:50 PM Break

10:50 – 11:10 AM **End-to-end Interactive Feature Analysis in Large-scale Multiphase Flow Simulations using In Situ Feature Extraction and Post-hoc Visual Analytics**
Soumya Dutta, Assistant Professor of Computer Science and Engineering, Indian Institute of Technology, Kanpur, India

11:10 – 11:30 AM **Exascale-ready tools for implementing particle methods with AMReX**
Andrew Myers, Lawrence Berkeley National Laboratory, CA

11:30 – 11:50 AM **MFIX-Exa: CFD-DEM simulations of thermodynamics and chemical reactions in multiphase flows**
Roberto Porcu[1,2], Jordan Musser[2], Ann S. Almgren[3], John B. Bell[3], William D. Fullmer[2], Deepak Rangarajan[1,2] ,[1]Battelle Memorial Institute, [2]National Energy Technology Laboratory,[3]Lawrence Berkeley National Laboratory

11:50 – 12:10 AM **PicassoMPM: Massively parallel material point method for additive manufacturing simulations**
Austin Isner, Sam Reeve, Kwitae Chong, Lance Bullerwell, Stuart Slattery, Oak Ridge National Laboratory

12:10 – 12:30 AM **Identification of compact closures for the multiphase RANS equations, with application to strongly-coupled gas-solid flows**
Sarah Beetham, Assistant Professor, Mechanical Engineering, Oakland University, CA

12:30 – 12:50 PM Break

Session Chair – David Huckaby

12:50 – 1:10 PM **Gas-liquid flow modeling for renewable fuels production**
Hari Sitaraman, Malik Hassanaly, Mohammad Rahimi, Yimin Lu, Milo-Parra Alvarez. National Renewable Energy Laboratory

1:10 – 1:30 PM **Flow pattern prediction using numerical simulation during flow boiling**

Ahmed Kouidri[1], Said Abboudi[2], Brahim Madani[1], [1]Laboratoire de Transport Poly-phasique et des Milieux Poreux, USTHB BP 32 El Alia 16111 Bab Ezzouar Alger, Algérie, [2]Institut IRTES-M3M, EA 7274, UTBM, site de Sévenans, 90010 Belfort cedex, France

1:30 – 1:50 AM **Radiative Heat Transfer in Gasifiers for Clean Hydrogen Production**
Gautham Krishnamoorty, University of North Dokota, ND

1:50 – 2:10 PM **Experiment-informed computational models for granular feedstock preprocessing and handling unit operations**
Yidong Xia, Energy and Environment Science & Technology Directorate, Idaho National Laboratory, Idaho Falls, Idaho 83412

2:10 – 2:30 PM **A fluidized bed approach for hydrogen production from natural gas using hot slag from steel plants**
Allan Runstedtler, Haining Gao, Natural Resources Canada, CanmetENERGY, Haanel Dr., Ottawa, Ontario, Canada

2:30 – 2:40 PM Break

Session Chair – Mehrdad Shahnam

2:40 – 3:00 AM **Eulerian simulation of an 8" circular fluidized bed unit at PSRI using a new EMMS drag model**
Behzadi, A., Tandon, M., Eppinger, T., Siemens Digital Industries Software

3:00 – 3:20 PM **Predicting Particle Dispersion Through the Application of the Transition $k-kl-\omega$ Turbulence Model and Lagrangian Method**
Amirmasoud Anvari[1], Sohaib Obeid[1], Andrea R. Ferro[2], Goodarz Ahmadi[1], [1]Department of Mechanical and Aerospace Engineering, Clarkson

University, [2]Department of Civil and Environmental Engineering, Clarkson University, Potsdam, NY

Wednesday, August 2, 2023
All times are Eastern Daylight Time

3:20 – 3:40 PM	**Large Eddy Simulation of Particle-laden Flows using the Spectral Element Method** *Muhsin M. Ameen, Juan Colmenares, Sicong Wu, Saumil S. Patel, Argonne National Laboratory*
3:40 – 4:00 PM	**A lattice Boltzmann method for predicting porous transport layer performance during electrolysis** *Ethan Young, Arth Sojitra, Jacob Wrubel, Marc Henry de Frahan, National Renewable Energy Laboratory, Golden, Colorado*
4:00 – 4:20 PM	**Computational Modeling of Acoustic-Solid Interaction for Early Kick Detection in Wellbores using Logging-While-Drilling Tools** *Felipe Simoes Maciel[1], Paulo Waltrich[1], Janine Galvin[2], Brian Tost[3], Foad Haeri[2], Brian Fronk[3], [1]Louisiana State University, [2]National Energy Technology Laboratory, [3]Oregon State University*
4:20 PM	**Workshop Ends**

Thank you for supporting NETL's 2023 Multiphase Flow Science Workshop! We appreciate all presenters and attendees!

Please send any feedback on this workshop including suggestions for future workshops to workshops@mfix.netl.doe.gov

2023 Multiphase Flow Science Workshop Day 1 Attendee Login Information

Webinar topic: **2023 Multiphase Flow Science Workshop Day 1**

Date and time: **Tuesday, August 1, 2023 9:00 AM | (UTC-04:00) Eastern Time (US & Canada)**

Join link: https://doe.webex.com/doe/j.php?MTID=m128634ddaae3fb529fd9f92ad74088ac

Webinar number: 2764 413 5591

Webinar password: **Multiphase (68584742 from phones and video systems)**

Join by phone: +1-415-527-5035 US Toll

Access code: 276 441 35591

2023 – Multiphase Flow Science Workshop Day 2 Attendee Login Information

Below you will find the Attendee Login information for Day 2. Both days can be provided on the website and on the agenda.

Webinar topic: **2023 Multiphase Flow Science Workshop Day 2**

Date and time: **Wednesday, August 2, 2023 9:00 AM | (UTC-04:00) Eastern Time (US & Canada)**

Join link: https://doe.webex.com/doe/j.php?MTID=m3f0a5039f94e778e4bc65249b6209ea9

Webinar number: 2760 797 3041

Webinar password: **Multiphase (68584742 from phones and video systems)**

Join by phone: +1-415-527-5035 US Toll

Access code: 276 079 73041