

Rahul Babu Koneru

Post-Doctoral Associate

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EDUCATION

University of Florida Ph.D. Mechanical Engineering	Gainesville, FL, USA <i>May 2020</i>
University of Florida M.S. Mechanical Engineering	Gainesville, FL, USA <i>May 2014</i>
Vignan's Institute of Information Technology B.Tech. Mechanical Engineering	Visakhapatnam, India <i>April 2012</i>

WORK EXPERIENCE

University of Maryland <i>Post-Doctoral Associate, Supervisor: Dr. Alison Flatau</i>	College Park, MD, USA <i>July 2020 - Present</i>
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- Current: Investigating the wettability and infiltration of molten CMAS on smooth and rough substrates using many-body dissipative particle dynamics (mDPD).
- Current: Investigating solid particulate deposition on material coupons treated with thermal barrier coatings in high-temperature environments using the two-way coupled Euler-Lagrange simulations.
- Performed LES of multi-can and full annular combustor simulations of Energy Efficient Engine (E3) combustor. Investigated the role of thermal fluctuations on the temperature asymmetry at the combustor exit.

University of Florida, Center for Compressible Multiphase Turbulence <i>Graduate Research Assistant, Advisor: Dr. S. Balachandar</i>	Gainesville, FL, USA <i>January 2015 - May 2020</i>
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- Conducted Euler-Lagrange (EL) simulations of a shock wave interacting with a dense bed of stationary spherical particles to ascertain the fidelity of the point-particle drag models in subcritical and supercritical conditions.
- Investigated the effects of incident shock Mach number, particle curtain thickness and particle volume fraction on the particle curtain dispersion to identify and reduce prediction uncertainties in the EL simulations of Sandia multiphase shock tube experiment.
- Performed four-way coupled Euler-Lagrange simulations of a shock wave interacting with a dense particle bed (particle volume fraction, 50%) in a cylindrical domain using CMT-Nek to study the development of jet-like instabilities caused due to shock driven multiphase instability.
- Performed large scale (up to 130K MPI ranks) Euler-Lagrange simulations of explosive dispersal (initial pressure ratio across the diaphragm, $10^2 - 10^5$) of annular particle beds (initial volume fraction, 5%-60%).

Lawrence Livermore National Laboratory <i>Summer Intern, Mentor: Dr. Kambiz Salari</i>	Livermore, CA, USA <i>July 2019 - August 2019</i>
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- Performed four-way coupled simulations of the Sandia multiphase shock tube to ascertain the importance of inter particle collisions using CMT-Nek.

TECHNICAL SKILLS

- **Programming/Scripting:** Fortran 90, Python, MATLAB, Bash
- **Libraries:** MPI, OpenMP, OpenACC, PyTorch

AWARDS & GRANTS

Q-Lab Seed Grant, University of Maryland, College Park

May 2022 - May 2023

Title: Towards Quantum Computational Fluid Dynamics

Role: Co-PI, Funding: \$20,000

Frontier Project, DoD HPCMP

May 2022 - May 2025

Title: Large-scale Integrated Simulations of Transient Aerothermodynamics in Gas Turbine Engines

Role: Co-Investigator Task Area 2-Advanced Combustor and Turbine Technologies, Allocation: ~200M CPU hours/year on DoD clusters

XSEDE Startup Allocation

September 2020 - September 2021

Title: Dynamics of Molten Particulate Deposition on Solid Surfaces

Role: PI, Allocation: 1600 node hours (\$512.16) on Stampede2 at TACC

University of Florida Informatics Institute Graduate Fellowship

August 2016 - August 2018

University of Florida Academic Achievement Award

August 2012 - May 2014

PROFESSIONAL SERVICES

- **Reviewer:** Physics of Fluids, International Journal of Multiphase Flow, Langmuir
- **Session Chair:** APS-DFD meeting November 2021.
- **Membership:** American Physical Society

STUDENT SUPERVISION (†B.S., ‡Ph.D.)

1. Garrett Foresman[†] (AEOP Apprentice), Summer 2022. Topic: CMAS spreading and infiltration on porous surfaces.
2. Saman Marandi[†], Summer 2021. Topic: Neural-network-based interface curvature estimation.
3. Bhargav Siddani[‡], Summer 2021. Topic: Data-driven flow and force predictions for dispersed multiphase flows.

SELECT TALKS & POSTER PRESENTATIONS

1. **Invited Talk (virtual):** Spreading dynamics of molten sand droplet. Complex fluids and Soft Matter Seminar Series, August 2022. YouTube Link: <https://youtu.be/HA56o39wLGw>
2. Talk: Multiscale modeling of molten particulate deposition in rotorcraft engines. Aerospace Engineering Seminar Series, University of Maryland, College Park, March 2022.
3. Talk: Wettability and infiltration of molten CMAS droplet on thermal barrier coatings. APS-DFD Meeting November 2021.
4. **Invited Talk (virtual):** Using ML for interfacial and transport phenomena in multiphase flows. DoD ITC Pacific/ITC Americas webinar on HPC Based Physics Based Modeling and Machine Learning, August 2021
5. Talk: Simulations of air-shock driven particle jetting in a dense particle bed. APS-DFD Meeting November 2020.
6. Talk: Evaluation of point-particle models in shock-particle bed interactions. APS-DFD Meeting November 2019.
7. **Invited Talk:** Shock-particle interaction and explosive dispersal of particles. Workshop on Physics and Modeling of Dispersed Multiphase Flows, Stanford University October 2018.
8. Poster: Euler-Lagrange simulations of shock-particle cloud interaction. Student Poster Symposium, LLNL July 2019. **Won best poster prize in the Computation and the Applied Science division.**

JOURNAL ARTICLES

1. **Koneru, Rahul Babu**, Alison Flatau, Zhen Li, Luis Bravo, Muthuvel Murugan, Anindya Ghoshal, and George Em Karniadakis. Quantifying the dynamic spreading of a molten sand droplet using multiphase mesoscopic simulations. *Phys. Rev. Fluids*, 7:103602, 2022

2. Frederick Ouellet, Bertrand Rollin, Bradford Durant, **Koneru, Rahul Babu**, and S Balachandar. Shock-driven dispersal of a corrugated finite-thickness particle layer. *Physics of Fluids*, 34(8):083301, 2022
3. F Ouellet, B Rollin, **Koneru, RB**, J Garno, and S Balachandar. Effects of perturbing the particle volume fraction distribution in blast-driven multiphase instability. *Shock Waves*, pages 1–24, 2021
4. Chanyoung Park, Samaun Nili, Justin T Mathew, Frederick Ouellet, **Koneru, Rahul**, Nam H Kim, Sivaramakrishnan Balachandar, and Raphael T Haftka. Uncertainty reduction for model error detection in multiphase shock tube simulation. *Journal of Verification, Validation and Uncertainty Quantification*, 6(3), 2021
5. **Koneru, Rahul Babu** and S Balachandar. An assessment of the drag models in the case of a shock interacting with a fixed bed of point particles. *Journal of Fluids Engineering*, 143(1):011401, 2021
6. **Koneru, Rahul Babu**, Bertrand Rollin, Bradford Durant, Frederick Ouellet, and S Balachandar. A numerical study of particle jetting in a dense particle bed driven by an air-blast. *Physics of Fluids*, 32(9):093301, 2020. **Editor’s pick**
7. Keke Zhai, Tania Banerjee, David Zwick, Jason Hackl, **Koneru, Rahul**, and Sanjay Ranka. Dynamic load balancing for a mesh-based scientific application. *Concurrency and Computation: Practice and Experience*, 32(9):e5626, 2020

CONFERENCE PROCEEDINGS

1. Bertrand Rollin, Frederick Ouellet, Bradford Durant, **Koneru, Rahul Babu**, and S Balachandar. Shock-induced multiphase instability in a high volume fraction finite-thickness particle layer. In *Fluids Engineering Division Summer Meeting*, volume 85307, page V003T08A014. American Society of Mechanical Engineers, 2021
2. Frederick Ouellet, Bertrand Rollin, Bradford Durant, **Koneru, Rahul Babu**, and S Balachandar. A gas-particle analogue to the Richtmyer-Meshkov instability: Comparing multiphase simulations to shock tube experiments. In *Fluids Engineering Division Summer Meeting*, volume 85307, page V003T08A018. American Society of Mechanical Engineers, 2021
3. Luis G Bravo, Muthuvel Murugan, Anindya Ghoshal, Simon Su, **Koneru, Rahul**, Nishan Jain, Prashant Khare, and Alison Flatau. Uncertainty quantification in large eddy simulations of CMAS attack and deposition in gas turbine engines. In *AIAA Scitech 2021 Forum*, page 0766, 2021
4. Muthuvel Murugan, Anindya Ghoshal, Michael Walock, Luis G Bravo, **Koneru, Rahul**, Nishan Jain, Clara Mock, Marc Pepi, Andy Nieto, Alison Flatau, et al. In search of durable sandphobic thermal/environmental barrier coatings for rotorcraft gas turbine engines. In *AIAA Scitech 2021 Forum*, page 0874, 2021

TECHNICAL REPORTS

1. Spencer Starr, **Rahul, Koneru B**, and Luis Bravo. Navier-stokes characteristic boundary conditions (NSCBC) for direct simulations of turbulent compressible flows in Athena-RFX. Technical report, US Army Combat Capabilities Development Command Defense High Performance Computing Modernization Program Office Lorton VA Maryland Univ College Park., 2022