Jesse Capecelatro

Assistant Professor @ University of Michigan

2011 W.E. Lay Automotive Lab
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▬▬▬ Education

2012–2014   **Ph.D.**, *Cornell University*, Mechanical & Aerospace Engineering.
Dissertation: *A mesoscopic formalism for simulating particle-laden flows with applications in energy conversion processes*

2011–2012   **M.S.**, *Cornell University*, Mechanical & Aerospace Engineering.

2009–2011   **M.S.**, *University of Colorado Boulder*, Mechanical Engineering.

2005–2009   **B.S.**, *Binghamton University - The State University of New York*, Mechanical Engineering, *Cum Laude*.

▬▬▬ Research Experience

Mar–Aug 2016   **Research Scientist**, *University of Illinois Urbana-Champaign*, Center for Exascale Simulation of Plasma-Coupled Combustion (XPACC).
- Developing adjoint-based methods for optimizing multi-component reactive flows
- Simulation development

2014–2016   **Postdoctoral Researcher**, *University of Illinois Urbana-Champaign*, Center for Exascale Simulation of Plasma-Coupled Combustion (XPACC).
- Large-scale simulations of turbulence transition over realistic roughness
- Adjoint-based sensitivity and optimization of combustion processes with localized ignition

May–July 2014   **Postdoctoral Researcher**, *Cornell University*, Computational Thermo-Fluids Laboratory led by Prof. O. Desjardins.
- Visitor at Institut de Mècanique des Fluides de Toulouse: Characterizing the effects of clusters on chemical conversion in reacting gas-solid flows
- Visitor at Ècole Centrale Paris: Numerical and theoretical investigation of cluster-induced turbulence in homogeneous and wall-bounded flows

2011–2014   **Graduate Research Assistant**, *Cornell University*, Computational Thermo-Fluids Laboratory led by Prof. O. Desjardins.
- Visitor at EM2C Laboratory, Ècole Centrale Paris: Investigated turbulence closures in gravity-driven fluid-particle flows
- Numerical study of the multiphase dynamic effects on biomass pyrolysis in circulating fluidized bed reactors
- Numerical investigation of turbulent slurry pipelines funded by Shell Oil

2010–2011   **Graduate Research Assistant**, *University of Colorado Boulder*, Computational Modeling of Energy Systems led by Prof. O. Desjardins.
- Development of a massively parallel framework for simulating dense fluidized beds in realistic geometries

2008–2009   **Undergraduate Research**, *Binghamton University - The State University of New York*, Department of Mechanical Engineering.
- Project manager / head mechanical engineer for the design and construction of a 1kW wind turbine

May–Aug 2008   **NSF sponsored Summer Research Experience for Undergraduates**, *University of Maine*, Forest Bioproducts Research Institute.
- Cultured bacteria to ferment sugars from woodchips for ethanol production

Refereed Journal Articles

2017

1. **Capecelatro, J.**, Desjardins, O., Fox, R. O. (2017) Transition between turbulence regimes in particle-laden channel flows. In preparation.
2. Buchta, D., Shallcross, G., **Capecelatro, J.** (2017) The role of particle-turbulence interactions on aeroacoustic noise in high-speed shear-flow turbulence. In preparation.
3. Kord, A., **Capecelatro, J.** (2017) Adjoint-based approach to control mixing in Rayleigh–Taylor instability. In preparation.
4. **Capecelatro, J.**, Bodony, D. J., Freund, J. B. (2017) Adjoint-informed ignition characterization of non-premixed combustion. In preparation.
5. Kong, B., Feng, H., **Capecelatro, J.**, Patel, R., Desjardins, O., Fox, R. O. (2017) Euler–Euler anisotropic Gaussian mesoscale simulation of homogeneous cluster-induced gas–particle turbulence, *AIChE Journal*. Accepted.

2016

6. **Capecelatro, J.**, Desjardins, O., Fox, R. O. (2016) Strongly-coupled gas-particle flows in vertical channels. Part I: Reynolds-averaged two-phase statistics, *Physics of Fluids*. 28, 1–22.
7. **Capecelatro, J.**, Desjardins, O., Fox, R. O. (2016) Strongly-coupled gas-particle flows in vertical channels. Part II: Turbulence modeling, *Physics of Fluids*. 28, 1–22.
8. **Capecelatro, J.**, Desjardins, O., Fox, R. O. (2016) Effect of domain size on fluid-particle statistics in homogeneous gravity-driven cluster-induced turbulence, *Journal of Fluids Engineering*. 138, 1–8.

2015

9. **Capecelatro, J.**, Desjardins, O., Fox, R. O. (2015) On fluid-particle dynamics in fully-developed cluster-induced turbulence, *Journal of Fluid Mechanics*. 780, 578–635.
10. **Capecelatro, J.**, Desjardins, O. (2015) Mass loading effects on turbulence modulation by particle clustering in dilute and moderately dilute channel flows, *Journal of Fluids Engineering*. 137, 1–8.
11. **Capecelatro, J.**, Pepiot, P., Desjardins, O. (2015) Numerical investigation and modeling of reacting gas-solid flows in the presence of clusters, *Chemical Engineering Science*. 122, 403–415.

2014

12. **Capecelatro, J.**, Desjardins, O., Fox, R. O. (2014) Numerical study of collisional particle dynamics in cluster-induced turbulence, *Journal of Fluid Mechanics*. 747, R2 1–13.
13. **Capecelatro, J.**, Pepiot, P., Desjardins, O. (2014) Numerical characterization and modeling of particle clustering in wall-bounded vertical risers, *Chemical Engineering Journal*. 245, 295–310.

2013

14. **Capecelatro, J.**, Desjardins, O. (2013) Eulerian-Lagrangian modeling of turbulent liquid-solid slurries in horizontal pipes, *International Journal of Multiphase Flow*. 55, 64–79.
15. **Capecelatro, J.**, Desjardins, O. (2013) An Euler-Lagrange strategy for simulating particle-laden flows, *Journal of Computational Physics*. 238, 1–31.

Refereed Conference Papers

2014

1. **Capecelatro, J.**, Desjardins, O., Fox, R. O. (2014) Investigating multiphase turbulence statistics of large-scale two-way coupled gravity-driven flows, *Proceedings of the ASME 2014 4th Joint US-European Fluids Engineering Division Summer Meeting*. August 3–7, 2014, Chicago, Illinois, USA.

2. **Capecelatro, J.**, Desjardins, O. (2014) Turbulence modulation by particle clustering in dilute and moderately dilute channel flows, *Proceedings of the ASME 2014 4th Joint US-European Fluids Engineering Division Summer Meeting*. August 3–7, 2014, Chicago, Illinois, USA.

Proceedings and Presentations

2017

1. **Capecelatro, J.**, Buchta, D. (2017) Direct numerical simulation of noise suppression by water injection in high-speed flows, 55th AIAA Aerospace Sciences Meeting, Grapevine, TX.

2. **Capecelatro, J.**, Bodony, D. J., Freund, J. B. (2017) Adjoint-based sensitivity analysis of ignition in a turbulent reactive shear layer, 55th AIAA Aerospace Sciences Meeting, Grapevine, TX.

2016

3. **Capecelatro, J.**, Bodony, D. J., Freund, J. B. (2016) Adjoint-based sensitivity of flames to ignition parameters in non-premixed shear-flow turbulence, 69th Annual Meeting of the APS Division of Fluid Dynamics, Portland, OR.

4. Kord, A., **Capecelatro, J.** (2016) Adjoint-based approach to Enhancing Mixing in Rayleigh-Taylor Turbulence, 69th Annual Meeting of the APS Division of Fluid Dynamics, Portland, OR.

5. Shallcross, G., Buchta, D., **Capecelatro, J.** (2016) Particle-turbulence-acoustic interactions in high-speed free-shear flows, 69th Annual Meeting of the APS Division of Fluid Dynamics, Portland, OR.

6. Kong, B., Patel, R., **Capecelatro, J.**, Desjardins, O., Fox, R. O. (2016) A Comparative Study of Euler-Euler and Euler-Lagrange Mesoscale Simulations of Moderately Dense Cluster-induced Gas-Particle Turbulence, 69th Annual Meeting of the APS Division of Fluid Dynamics, Portland, OR.

7. Patel, R., Kong, B., **Capecelatro, J.**, Fox, R. O., Desjardins, O. (2016) A numerical study of bidisperse particles in cluster-induced turbulence, 69th Annual Meeting of the APS Division of Fluid Dynamics, Portland, OR.

8. Fox, R. O., Ireland, P. J., Patel R., **Capecelatro, J.**, Desjardins, O. (2016) Clustering in gas-solid flows: How are clusters modified by shear?, 2016 AIChE Annual Meeting, San Francisco, CA.

9. Kong, B., Patel R., **Capecelatro, J.**, Desjardins, O., Fox, R. O. (2016) A comparative study of Euler-Euler and Euler-Lagrange mesoscale simulations of moderately dense gas-solid flows, 2016 AIChE Annual Meeting, San Francisco, CA.

10. **Capecelatro, J.**, Desjardins, O., Fox, R. O. (2016) Recent insights on disperse multiphase turbulence modeling, NETL 2016 Workshop on Multiphase Flow Science, Morgantown, WV.

11. **Capecelatro, J.**, Bodony, D. J., Freund, J. B. (2016) Adjoint-informed ignition characterization, 24th International Conference on Theoretical and Applied Mechanics, Montreal, Canada.

12. **Capecelatro, J.**, Bodony, D. J., Freund, J. B. (2016) An adjoint-based search method for an ignition threshold, 12th World Congress on Computational Mechanics, Seoul, South Korea.

13. **Capecelatro, J.**, Vishnampet, R., Bodony, D. J., Freund, J. B. (2016) Adjoint-based sensitivity analysis of localized ignition in a non-premixed hydrogen–air mixing layer, 54th AIAA Aerospace Sciences Meeting, San Diego, CA.

14. Fox, R. O., **Capecelatro, J.**, Desjardins, O. (2016) Strongly coupled particle-laden flows in vertical channels, 9th International Conference on Multiphase Flow, Florence, Italy.

2015

15. **Capecelatro, J.**, Zhang, W., Fontaine, R., Elliot, G. S., Bodony, D. J., Freund, J. B. (2015) Bypass transition of low-speed boundary layers using realistic sandpaper roughness, 68th Annual Meeting of the APS Division of Fluid Dynamics, Boston, MA.
16. Fox, R. O., **Capecelatro, J.**, Desjardins, O. (2015) Strongly coupled turbulent gas-particle flows in vertical channels, 68th Annual Meeting of the APS Division of Fluid Dynamics, Boston, MA.
17. Ireland, P. J., **Capecelatro, J.**, Fox, R. O., Desjardins, O. (2015) Correcting velocity and volume-fraction calculations in two-way-coupled, particle-laden-flow simulations, 68th Annual Meeting of the APS Division of Fluid Dynamics, Boston, MA.
18. Kong, B., Feng, H., **Capecelatro, J.**, Desjardins, O., Fox, R. O. (2015) Euler-Euler anisotropic Gaussian mesoscale direct numerical simulation of homogeneous and wall-bounded cluster-induce gas-particle turbulence, 68th Annual Meeting of the APS Division of Fluid Dynamics, Boston, MA.
19. Fox, R. O., **Capecelatro, J.**, Desjardins, O. (2015) Turbulent Gas-Particle Flow in Wall-Bounded Vertical Risers, 2015 AIChE Annual Meeting, Salt Lake City, UT.
20. Ireland, P. J., **Capecelatro, J.**, Fox, R. O., Kasbaoui, M. H., Desjardins, O. (2015) Numerical Simulation of Sheared, Gas-Particle, Cluster-Induced Turbulence, 2015 AIChE Annual Meeting, Salt Lake City, UT.
21. Fox, R. O., **Capecelatro**, Desjardins, O. (2015) Turbulent Gas-Particle Flow in Wall-Bounded Vertical Risers, 2015 AIChE Annual Meeting, Salt Lake City, UT.
22. Kong, B., Deng, H., **Capecelatro, J.**, Desjardins, O., Fox, R. O. (2015) Euler-Euler Anisotropic Gaussian Mesoscale Direct Numerical Simulation of Homogeneous and Wall-Bounded Cluster-Induce Gas-Particle Turbulence, 2015 AIChE Annual Meeting, Salt Lake City, UT.
23. Arolla, S., **Capecelatro, J.**, Fox, R. O., Desjardins, O. (2015) Sand Transport Modeling in Multiphase Pipelines Based on Euler-Lagrange Large Eddy Simulation Data, 2015 AIChE Annual Meeting, Salt Lake City, UT.
24. Kong, B., Feng, H., **Capecelatro, J.**, Desjardins, O., Fox, R. O. (2015) Euler-Euler anisotropic Gaussian mesoscale direct numerical simulation of homogeneous cluster-induced gas-particle turbulence, NETL 2015 Workshop on Multiphase Flow Science, Morgantown, WV.

2014

25. **Capecelatro, J.**, Desjardins, O., Fox, R. O. (2014) Fluid-particle characteristics in fully-developed cluster-induced turbulence, 67th Annual Meeting of the APS Division of Fluid Dynamics, San Francisco, CA.
26. Fox, R. O., **Capecelatro, J.**, Desjardins, O. (2014) Multiphase turbulence in vertical wall-bounded collisional gas-particle flows, 67th Annual Meeting of the APS Division of Fluid Dynamics, San Francisco, CA.
27. **Capecelatro, J.**, Desjardins, O., Fox, R. O. (2014) Turbulence modeling of collisional gas-particle flows in wall-bounded risers, 2014 AIChE Annual Meeting, Atlanta, GA.
28. Fox, R. O., **Capecelatro, J.**, Desjardins, O. (2014) The role of granular temperature in turbulent gas-particle flows, 2014 AIChE Annual Meeting, Atlanta, GA.
29. Arolla, S., **Capecelatro, J.**, Desjardins, O. (2014) Numerical prediction of critical deposition velocity for turbulent liquid-solid slurry flow through a horizontal pipe, 2014 AIChE Annual Meeting, Atlanta, GA.
30. **Capecelatro, J.**, Desjardins, O. (2014) Turbulence modulation by particle clustering in dilute and moderately dilute channel flows, Proceedings of the ASME 2014 4th Joint US-European Fluids Engineering Division Summer Meeting, Chicago, IL.
31. **Capecelatro, J.**, Desjardins, O., Fox, R. O. (2014) Investigating multiphase turbulence statistics of large-scale two-way coupled gravity-driven flows, Proceedings of the ASME 2014 4th Joint US-European Fluids Engineering Division Summer Meeting, Chicago, IL.
32. Desjardins, O., **Capecelatro, J.**, Fox, R. O. (2014) An adaptive filter strategy for extracting multiphase flow statistics from Euler-Lagrange simulations, NETL 2014 Workshop on Multiphase Flow Science, Morgantown, WV.
33. Desjardins, O., **Capecelatro, J.**, Pepiot, P. (2014) Numerical investigation and modeling of reacting gas-solid flows in the presence of clusters, NETL 2014 Workshop on Multiphase Flow Science, Morgantown, WV.
34. **Capecelatro, J.**, Arolla, O., Desjardins, O. (2014) Eulerian-Lagrangian large eddy simulations of liquid-solid slurries, 17th U.S. National Congress on Theoretical & Applied Mechanics, Michigan State University, East Lansing, MI.
35. Fox, R. O., **Capecelatro, J.**, Desjardins, O. (2014) Numerical investigation of particle dynamics in cluster-induced turbulent flows, 17th U.S. National Congress on Theoretical & Applied Mechanics, Michigan State University, East Lansing, MI.

2013

36. **Capecelatro, J.**, Desjardins, O. (2013) A study of turbulence modulation by particle clusters in dilute and moderately-dilute channel flows using mesoscale DNS, 66th Annual Meeting of the APS Division of Fluid Dynamics, Pittsburgh, PA.

37. Fox, R. O., **Capecelatro, J.**, Desjardins, O. (2013) Evaluating multiphase turbulence statistics using mesoscale DNS of gravity-driven particle-laden flows, 66th Annual Meeting of the APS Division of Fluid Dynamics, Pittsburgh, PA.

38. Arolla, S., **Capecelatro, J.**, Desjardins, O. (2013) Eulerian-Lagrangian large eddy simulations of dense liquid-solid slurry flow through a horizontal pipe, 66th Annual Meeting of the APS Division of Fluid Dynamics, Pittsburgh, PA.

39. **Capecelatro, J.**, Desjardins, O., Fox, R. O. (2013) Turbulence Modeling of Collisional Gas-Particle Flows, 2013 AIChE Annual Meeting, San Francisco, CA.

40. **Capecelatro, J.**, Desjardins, O., Pepiot, P., Jarvis, M., Foust T. (2013) Numerical Investigation of Multiphase Dynamic Effects in Catalytic Upgrading of Biomass Pyrolysis Vapor, 2013 AIChE Annual Meeting, San Francisco, CA.

41. **Capecelatro, J.**, Desjardins, O. (2013) A fully coupled multiscale approach for simulating fluid-particle flows, NETL 2013 Workshop on Multiphase Flow Science, Morgantown, WV.

42. Fox, R. O., **Capecelatro, J.**, Desjardins, O. (2013) Validation of a multiphase turbulence model using mesoscale DNS of gravity-driven gas-particle flow, NETL 2013 Workshop on Multiphase Flow Science, Morgantown, WV.

43. **Capecelatro, J.**, Desjardins, O., Pepiot, P., JARVIS, M., FOUST T. (2013) Numerical Investigation of Multiphase Dynamic Effects in Catalytic Upgrading of Biomass Pyrolysis Vapor, 2013 AIChE Annual Meeting, San Francisco, CA.

44. **Capecelatro, J.**, JARVIS, M., Desjardins, O. (2013) A numerical investigation of turbulent particle-laden flows in vertical risers, 8th International Conference on Multiphase Flow, Jeju, Korea.

2012

45. **Capecelatro, J.**, Desjardins, O. (2012) A numerical investigation of cluster fall velocity in vertical particle-laden turbulent pipe flow, 65th Annual Meeting of the APS Division of Fluid Dynamics, San Diego, CA.

46. **Capecelatro, J.**, Desjardins, O. (2012) Detailed investigation of clustering in riser flows using an Euler-Lagrange approach, 244th ACS National Meeting & Exposition, Philadelphia, PA.

47. Malhotra, K., Pepiot, P., **Capecelatro, J.**, Desjardins, O. (2012) Impact of feed injection strategies on fluidization dynamics for biomass thermochemical conversion, 244th ACS National Meeting & Exposition, Philadelphia, PA.

48. **Capecelatro, J.**, Desjardins, O. (2012) A massively parallel Euler-Lagrange strategy for simulating fluidized bed reactors, NETL 2012 Workshop on Multiphase Flow Science, Morgantown, WV.

2011

49. **Capecelatro, J.**, Desjardins, O., Pepiot, P. (2011) Large-scale simulations of realistic fluidized bed reactors using novel numerical methods, 64th Annual Meeting of the APS Division of Fluid Dynamics, Baltimore, MD.

50. Desjardins, O., **Capecelatro, J.**, (2011) Large-scale Eulerian-Lagrangian simulations of turbulent particle-laden riser flows, 64th Annual Meeting of the APS Division of Fluid Dynamics, Baltimore, MD.

51. Pepiot, P., **Capecelatro, J.**, Desjardins, O. (2011) Effect of particle devolatilization on bed dynamics during biomass thermochemical conversion, 64th Annual Meeting of the APS Division of Fluid Dynamics, Baltimore, MD.

2010
52. **Capecelatro, J.**, Pepiot, P., Desjardins, O. (2010) Eulerian-Lagrangian simulation of three-dimensional turbulent riser flows, 63rd Annual Meeting of the APS Division of Fluid Dynamics, Long Beach, CA.

Invited Lectures

Aug 2016 "Adjoint-based methods for optimization and UQ of multiphase flows", National Energy Technology Laboratory Technical Seminar

Feb 2016 "Particles, turbulence, and adjoint-based sensitivity: targeting energy and environmental challenges with high-performance computing", Mechanical engineering seminar series, University of New Hampshire, NH

Jan 2016 "Particles, turbulence, combustion, and adjoint-based sensitivity: targeting energy challenges with high-performance computation", Mechanical engineering seminar series, University of Michigan, MI

Jul 2015 "Towards predictive simulations of plasma-assisted ignition of a fuel jet in a turbulent crossflow", Turbulence seminar, Los Alamos National Lab, New Mexico

Sep 2014 "Recent progress in understanding disperse multiphase flows: a theoretical formalism and numerical study of cluster-induced turbulence", Fluid mechanics seminar, University of Illinois, Urbana-Champaign, Illinois

May 2014 "Methods for simulating large-scale particle-laden flows with applications in energy conversion processes", University of Illinois, Urbana-Champaign, Illinois

Mar 2014 "Using supercomputers to study biofuel production and injection", US Military Academy, West Point, New York

Feb 2014 "Exploring multiphase dynamics in energy conversion systems using super computers", Mechanical Engineering seminar series, Binghamton University, Binghamton, New York

Jun 2013 "Exploring turbulent particle-laden flows using large-scale numerical simulations", Ècole Centrale Paris, EM2C Laboratory, Paris, France

Teaching Experience

Spring 2011 **Teaching Assistant**, *University of Colorado*, Undergraduate/Graduate Flow Visualization.

Spring 2010 **Teaching Assistant**, *University of Colorado*, Undergraduate/Graduate Flow Visualization.

Spring 2010 **Teaching Assistant**, *University of Colorado*, Undergraduate/Graduate Wind Energy.

Fall 2009 **Teaching Assistant**, *University of Colorado*, Undergraduate Fluid Mechanics.

Outreach

2015–2016 **Subject-area mentor to a high student**, *Brewster High School, Brewster NY*.
Intel International Science and Engineering Fair (Intel ISEF) competition.
- Turbulent enhanced heat transfer in geothermal pipelines
- Effects of surface roughness on heat transfer in pipes

Fall 2015 **Guest lecturer**, *University Primary School at the University of Illinois*.
Several guest lectures on "science of sound" for grades 2, 3, 4, and 5
- Lessons covered properties of waves, the Doppler effect, and different mediums sound can travel through
- Visualizations of standing waves using a home-built Rubens tube

Fall 2014 **Guest lecturer**, *University Primary School at the University of Illinois*.
Several guest lectures on "physics of flight" for grades 2, 3, 4, and 5
○ Demonstrations of Bernoulli's principle, group activities to demonstrate the motion of gases (pressure, velocity, and vorticity)

Awards & Honors

2015 Video of the Month award: *Jet in Crossflow of a Spatially Evolving Turbulent Boundary Layer*, Coordinated Science Laboratory, University of Illinois at Urbana-Champaign

2014 The Jayesh Prize in recognition of outstanding presentation in the Cornell Fluid Dynamics Seminar, Spring 2014

2011 Outstanding Teacher Assistant Award, Department of Mechanical Engineering, University of Colorado

2010 Best Presentation for First-Year Graduate Student Prize, Graduate Engineering Annual Research Symposium, University of Colorado

2010 Honorable Mention, NSF: Graduate Student Research Fellowship Program

2009 MacDonald Family Prize in Senior Design, First place senior capstone, Department of Mechanical Engineering, Binghamton University

2008 Binghamton University Faculty-Student Scholarship Program

2008 Tau Beta Pi, The Engineering Honor Society

2008 Pi Tau Sigma, The Mechanical Engineering Honor Society

Academic Activities

2013–2014 Cornell Fluid Dynamics Seminar (CFDS), seminar organizer, Cornell University

2009–2011 The Collaborative for Fluid and Energy Sciences, active member / organizer, University of Colorado

2009–2010 Graduate Engineering Annual Research Symposium Committee, webmaster, University of Colorado

2007–2009 Engineers Without Borders (EWB), committee webmaster and project design leader, Binghamton University

Journal Referee

- Physics of Fluids
- Journal of Computational Physics
- American Institute of Chemical Engineers
- Chemical Engineering Science
- Chemical Engineering Research and Design