Douglas Fontes

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https://sites.google.com/view/dfontes

https://www.researchgate.net/profile/Douglas_Fontes

https://scholar.google.com/citations?user=4bO6Mp8AAAAJ&hl=en

https://www.youtube.com/channel/UCobHfxrZvi3Xo88eSxZFnwg

Biographical sketch

Douglas Fontes is currently an assistant professor in the Engineering Program at Westmont College. Recently, He concluded a postdoctoral research at the Florida Space Institute, University of Central Florida, working with numerical modeling of multiphase flow. He received his doctorate in Mechanical Engineering (2018) in the thermo-fluid area, investigating spray formation in a liquid jet in crossflow configuration. Dr. Fontes has vast experience with numerical modeling of complex thermo-fluid phenomena, such as turbulence, compressible flows, natural and forced convection, and two-phase flows. He was a student representative at faculty councils, participating in administrative functions within faculty departments. Dr. Fontes also has experience in teaching courses related to thermo-fluid, the resistance of materials, and calculus, often using active learning methodologies, such as Team-Based Learning.

Skills

Programming Language:

C, C++, Fortran, Python, MATLAB

CFD Software:

Commercial codes: OpenFoam, StarCCM+, Ansys, Code Saturne

In-house codes: ESLA, UNCYFL3D

Awards

Best paper: Week Forum of Mechanical Engineering 2012, Federal University of Uberlandia

Bronze Medal: Brazilian Math Olympiad of Public Schools 2007

Silver Medal: Brazilian Math Olympiad of Public Schools 2006

Silver Medal: Brazilian Math Olympiad of Public Schools 2005

Languages

English: Fluent
Portuguese: Fluent

Academic background

Post-doctorate in Florida Space Institute (Aug. 2020 – Feb. 2022)

University of Central Florida, Computational Fluid and Aerodynamics Laboratory

Concentrations: two-phase flow, rarefied gas flow, CFD.

Research Overview: Numerical simulations of rocket jet plume interacting with lunar soil. Numerical modeling of rarefied flows with particulate using RANS and DSMC (Direct Simulation Monte Carlo). (Advised by Dr. Philip Metzger).

Post-doctorate in Mechanical and Aerospace Engineering (Feb. 2019 – Jul. 2020)

University of Central Florida, Computational Fluid and Aerodynamics Laboratory

Concentrations: Compressible flow, high-fidelity simulations, turbulence modeling, two-phase flow, rarefied gas flow, CFD.

Research Overview: Numerical simulations of compressible flow interacting with solid particles. High fidelity simulations using flux reconstruction methods for compressible and incompressible flows. Rarefied flows using DSMC (Direct Simulation Monte Carlo) method. (Advised by Dr. Michael P. Kinzel).

Doctorate in Mechanical Engineering (Apr. 2015 - Dec. 2018)

Federal University of Uberlândia (Universidade Federal de Uberlândia - UFU), Brazil, Fluid Mechanics Laboratory

Thesis Title: "Numerical Study of Liquid Jet in Crossflow Using a Hybrid Approach"

Concentrations: Two-phase flow, spray, CFD, fluid dynamics, and turbulence modeling.

Research Overview: Implemented a hybrid approach, considering the effects of two-way and four-way couplings in spray formation in a liquid jet in crossflow. Different modeling for the primary breakup and secondary breakup of the droplets was evaluated. The computational framework presented a good agreement with experimental data and low computational cost. (Advised by Dr. Francisco José de Souza).

M.S. in Mechanical Engineering (Mar. 2013 - Mar. 2015)

Federal University of Uberlandia (Universidade Federal de Uberlândia - UFU), Brazil, Laboratory of Thermal Energy Systems

Thesis Title: "Numerical simulation of the flow of dispersions based on transformer oil in closed cavities"

Concentrations: Numerical simulation, heat transfer, nanoparticles, electrical transformers, nanofluids

Research Overview: Numerical simulations of natural convection of the dispersion of nanoparticles in the transformer oil inside a cavity. Experimental measurements of the nanofluids were obtained. A numerical code written in C language was implemented to solve the evaluated cases. (Advised by Dr. Enio Pedone Bandarra Filho and Dr. Elie Luis Martinez Padilla).

B.S. in Mechanical Engineering (Mar. 2008 - Feb 2014)

Federal University of Uberlândia (Universidade Federal de Uberlândia - UFU), Brazil

Concentrations: Aerodynamics, computational fluid dynamics, and mechanical design.

Research Overview: Numerical calibration of devices of pressure reduction to measure the flow rate. Turbulent flow was considered, and discharge coefficients were calibrated for the experimental measurements (supervised by Dr. Francisco José de Souza).

Scholarship

Period	Role	Program/Sponsor	Amount for the Period
March 2021 - February 2022	Postdoctoral Research Scholar	Preeminent Postdoctoral Program-P3/UCF	$ 29,583.00 (USD)
February 2019 - February 2021	Postdoctoral Research Scholar	Preeminent Postdoctoral Program-P3/UCF	$ 60,000.00 (USD)
March 2015 - August 2018	Graduate Research Scholar	Academic Excellence Program/CAPES - Brazil	R$ 92,400.00 (BRL)
March 2013 - February 2015	Graduate Research Scholar	Academic Excellence Program/CAPES - Brazil	R$ 35,850.00 (BRL)
August 2012 - December 2012	Undergraduate Research Scholar	NANBIO/CAPES - Brazil	R$ 2000.00 (BRL)
January 2006 - December 2007	High School Scholar	Junior Scientific Initiation Program (PIC)/CNPq - Brazil	R$ 1,200.00 (BRL)

Research

Pending Research Project

Period	PI	Project Title	Role	Sponsor	Amount for the Period

Current Research Project

Period	PI	Project Title	Role	Sponsor	Amount for the Period
March 2021 - February 2022	Dr. Douglas Fontes	Fluid Flow Science and Research for Space Technology Applications	Researcher	Florida Space Institute, UCF	$ 20,871.00 (USD)
October 2020 - January 2021	Dr. Philip Metzger	Testing Deep Cratering Physics to Inform Plume Effects Modeling (subcontract)	Postdoctoral Researcher	Masten Space Systems, Inc.	$ 36,172.00 (USD)

Past Research Project

Period	PI	Project Title	Role	Sponsor	Amount for the Period
January 2020 - February 2021	Matthew Kuhns	FAST Landing Pads (Subcontract)	Postdoctoral Researcher	NASA	$ 7,665.00 (USD)
June 2020 - March 2021	Dr. Philip Metzger	Human Landing System Rocket Plume Studies (#80NSSC20M0012)	Postdoctoral Researcher	NASA	$ 49,664.00 (USD)
February 2019 - July 2020	Dr. Michael Kinzel	Abrasive Blasting Noise Control – SBIR N172-134, NCE Phase II (Subcontract)	Postdoctoral Researcher	US Navy	$ 184,000.00 (USD)
January 2015 - December 2017	Dr. Francisco José de	Simulation of spray formation (#TEC-APQ-02191-16)	Graduate Researcher	Foundation for Research of the State of	R$ 48,574.26 (BRL)

	Souza			Minas Gerais - Brazil	
February 2017 - December 2018	Dr. Francisco José de Souza	Numerical simulation of multiphase flow inside load dispersers of catalytic cracking (#2015/00334-1)	Graduate Researcher	Petrobras Oil Company - Brazil	R$ 887,453.36 (BRL)
March 2013 - February 2015	Dr. Enio Pedone Bandarra Filho	Heat transfer enhancement in nanofluid flow considering natural convection	Graduate Researcher	CAPES - Brazil	---
March 2011 - February 2012	Dr. Enio Pedone Bandarra Filho	Heat transfer enhancement using nanofluids inside tubes	Undergraduate Researcher	CAPES - Brazil	---

Publications

General Statistics of Dr. Fontes publications from Dr. Fontes's Google Scholar.

Citations	h-index	i10-index
206	6	5

Journal papers

1. Velasco LJ, Venturi DN, **Fontes DH**, de Souza FJ. Numerical simulation of drag reduction by microbubbles in a vertical channel. Eur J Mech - B/Fluids. 2022;92:215-225. doi:10.1016/j.euromechflu.2021.12.007

2. Reyes J, **Fontes D**, Bazzi A, Otero M, Ahmed K, Kinzel M. Effect of saliva fluid properties on pathogen transmissibility. Sci Rep. 2021;11(1):16051. doi:10.1038/s41598-021-95559-6

3. Hartig M, Stephens C, Foster A, **Fontes D**, Kinzel M, García-Godoy F. Stopping the COVID-19 pandemic in dental offices: A review of SARS-CoV-2 transmission and cross-infection prevention. Exp Biol Med. Published online August 3, 2021:153537022110341. doi:10.1177/15353702211034164

4. **Fontes D**, Reyes J, Ahmed K, Kinzel M. A study of fluid dynamics and human physiology factors driving droplets dispersion from a human sneeze. Phys Fluids. 2020;111904(November). doi:10.1063/5.0032006

5. **Fontes, D. H**., Vilela, V., Souza Meira, L. de, & José de Souza, F. (2019). Improved Hybrid Model Applied to Liquid Jet in Crossflow. International Journal of Multiphase Flow, 114, 98–114. https://doi.org/10.1016/j.ijmultiphaseflow.2019.02.009

6. **Fontes, D.H.**, Ribeiro Duarte, C. A., & de Souza, F. J. (2018). Numerical Simulation of a Water Droplet Splash: Effects of Density Interpolation Schemes. Mechanics Research Communications, 90, 18–25. https://doi.org/10.1016/j.mechrescom.2018.04.003

7. **Fontes, D. H**., Padilla, E. L. M., dos Santos, D. D., & Bandarra Filho, E. P. (2017). Numerical Study of The Natural Convection of Nanofluids Based on Mineral Oil with Properties Evaluated Experimentally. International Communications in Heat and Mass Transfer, 85, 107–113. https://doi.org/10.1016/j.icheatmasstransfer.2017.05.003

8. **Fontes, D. H**., Ribatski, G., & Bandarra Filho, E. P. (2015). Experimental Evaluation of Thermal Conductivity, Viscosity and Breakdown Voltage AC of Nanofluids Of Carbon Nanotubes and Diamond in Transformer Oil. Diamond and Related Materials, 58, 115–121. https://doi.org/10.1016/j.diamond.2015.07.007

9. **Fontes, D. H**., Dall, D., Luis, E., Padilla, M., Pedone, E., & Filho, B. (2015). Two Numerical Modelings Of Free Convection Heat Transfer Using Nanofluids Inside A Square Enclosure. Mechanics Research Communications, 66, 34–43. https://doi.org/10.1016/j.mechrescom.2015.03.009

Conference articles and Presentations

1. **Fontes DH**, Metzger PT. Rocket Plume Interacting with Mars Soil Particulates. In: AIAA SCITECH 2022 Forum. American Institute of Aeronautics and Astronautics; 2022:5-7. doi:10.2514/6.2022-0742

2. **Fontes DH**, Metzger PT. Evaluation of Different RANS Turbulence Models for Rocket Plume on Mars Environment. In: AIAA SCITECH 2022 Forum. American Institute of Aeronautics and Astronautics; 2022:1-13. doi:10.2514/6.2022-0741

3. Loubimov GE, **Fontes DH**, Kinzel MP. Three Dimensional CFD Analysis of the Sprayed Liquid Flap. In: AIAA SCITECH 2022 Forum. American Institute of Aeronautics and Astronautics; 2022:1-13. doi:10.2514/6.2022-1529

4. Loubimov G., Kinzel M., **Fontes DH.**, (2021) Novel Induced Drag Predictions using CFD; Applications to Sprayed Liquid Flaps. 74th Annual Meeting of the APS Division of Fluid Dynamics.

5. **Fontes DH.**, Mantovani J., Metzger P, Lunar Regolith Particles Interacting with Lander Rocket Plume at lower Altitudes, In: LunGradCon 2021.

6. **Fontes DH.**, Mantovani J., Metzger P, Lunar Regolith Particles Interacting with a Lander Rocket Plume at lower Altitudes, In: NESF & ELS 2021.

7. Metzger PT, **Fontes DH**. A Regime for Mitigating Lunar Lander Plume Ejecta. In: LUNAR SURFACE INNOVATION CONSORTIUM. ; 2020:208.

8. Wittal MM, Vu B, Mantovani J, Metzger PT, **Fontes DH**. Understanding the Impact of High-Velocity Dust Due to Lunar Landings. In: LUNAR SURFACE INNOVATION CONSORTIUM. ; 2020:43.

9. Loubimov, George, **Douglas Fontes**, Garett Loving, and Michael Kinzel. 2020. "Using Liquid Spray Formations to Improve Aerodynamic Performance of Airfoils." In ASME 2020 Fluids Engineering Division Summer Meeting Collocated with the ASME 2020 Heat Transfer Summer Conference and the ASME 2020 18th International Conference on Nanochannels, Microchannels, and Minichannels. American Society of Mechanical Engineers Digital Collection. https://doi.org/10.1115/FEDSM2020-20078.

10. **Fontes, Douglas**, and Michael Kinzel. 2020. "Virus Transmission: Sensitivity Study of the Nasal/Buccal Geometries and Saliva Properties." Bulletin of the American Physical Society.

11. Kinzel, Michael, Jonathan Reyes, **Douglas Fontes**, Michelle Otero, and Kareem Ahmed. 2020. "Saliva Content and Viscosity and Its Impact on Droplet Formation and Pathogen Transmission." Bulletin of the American Physical Society.

12. Anderson, Caroline, **Douglas H. Fontes**, and Michael Kinzel. 2020. "Modeling Droplet Breakup of Viscoelastic Fluids for Mitigation of Viral Particulate Transmission." Bulletin of the American Physical Society.

13. **Fontes, D. H.**, Mikkelsen, D., Kinzel, M. P., (2020). Analysis of Rocket Jet Particulate using Euler-Lagrange and Euler-Euler Approaches. 2020 AIAA SciTech Forum.

14. Forehand, R. W., **Fontes, D. H**., Kinzel, M. P., (2020). Lagrangian Numerical Analysis of Liquid Jet in Subsonic Crossflow. 2020 AIAA SciTech Forum.

15. Yeager, T. R., **Fontes, D. H.**, Metzger, P., D., Kinzel, M. P., (2020). Numerical Simulation of Rocket Jet in a Rarefied Atmosphere using Euler-Euler Approach. 2020 AIAA SciTech Forum.

16. Velasco LJ, Venturi DN, **Fontes D**, Souza F. Numerical simulation of drag reduction by microbubbles in a vertical channel. In: Proceedings of the 12th Spring School on Transition and Turbulence. ABCM; 2020:16. doi:10.26678/ABCM.EPTT2020.EPT20-0087

17. **Fontes, D. H.**, D., Kinzel, M. P. (2019). LES of Compressible Gas Flow Impinging on a Wall using High Order Schemes in an Unstructured Grid. 72nd Annual Meeting of the APS Division of Fluid Dynamics.

18. Yeager, T. R., **Fontes, D.**, Kinzel, M. P. (2019). Analysis of Flow Over a Sphere using Direct Simulation Monte Carlo Method in OpenFOAM. 72nd Annual Meeting of the APS Division of Fluid Dynamics.

19. **Fontes, D. H**., Souza, F. J. De, & Meira, L. S. (2019). A Hybrid Approach Applied to Spray in Liquid Jet in Crossflow. ILASS-Americas 30th Annual Conference on Liquid Atomization and Spray Systems, Tempe, AZ, May 2019, (May), 13.

20. **Fontes, D. H.**, Meira, L. S., Canabarro, L. R., Souza, F. J. De (2019). A Hybrid approach for modeling sprays in crossflow. 10th International Conference on Multiphase Flow, Rio de Janeiro, Brazil, May.

21. **Fontes, D. H.**, & de Souza, F. J. (2017). Numerical Analysis of Jet in Crossflow Spray. 24th ABCM International Congress of Mechanical Engineering, 3–8.

22. **Fontes, D. H**., dos Santos, D. D., Padilla, E. L. M., & Bandarra Filho, E. P. (2015). Two Numerical Modelings Of Free Convection Heat Transfer Using Nanofluids. 23rd ABCM International Congress of Mechanical Engineering.

23. **Fontes, D. H.**, Bandarra Filho, E. P., & Camacho, J. R. (2014). Medições De Propriedades De Nanofluidos De Diamante Em Óleo De Transformador Elétrico. Mercofrio-Congresso Internacional de Ar Condicionado, Refrigeração, Aquecimento e Ventilação.

24. **Fontes, D. H.**, Padilla, E. L. M., & Bandarra Filho, E. P. (2014). Nanofluids Based on Oil Flowing Inside an Electrical Transformer Simplified. XXXV Iberian Latin American Congress on Computational Methods in Engineering, 13.

25. **Fontes, D. H.**, Padilla, E. L. M., & Bandarra Filho, E. P. (2014). Simulação Numérica da Convecção Natural Em Cavidade Bidimensional Utilizando Nanofluidos. VIII Congresso Nacional de Engenharia Mecânica, 7.

26. Rodrigues, N. L., **Fontes, D. H**., & Bandarra Filho, E. P. (2014). A Review on Applications of Nanofluids In Automotive Cooling System. ENCIT 2014, (15th Brazilian Congress of Thermal Sciences and Engineering), 7.

27. **Fontes, D. H.** (2014). Calibração De Medidores De Vazão Via Dinâmica Dos Fluidos Computacional. VIII Congresso Nacional de Engenharia Mecânica.

28. **Fontes, D. H.**, & Bandarra Filho, E. P. (2013). Verificação e validação de um código computacional para simulação de escoamentos bidimensionais. Simpósio Do Programa de Pós Graduação Faculdade de Engenharia Mecânica, (2), 23–26.

29. **Fontes, D. H.**, Bandarra Filho, E. P. (2013). Critérios de Comparação para Análise de Nanofluidos.

30. **Fontes, D. H.**, & Bandarra Filho, E. P. (2013). Theoretical Analysis of Alumina-Water Nanofluids Flowing in Horizontal Tubes. 22nd International Congress of Mechanical Engineering, (Cobem), 7.

Patents

Kinzel, M., Ahmed, K.A., Reyes, J., **Fontes, D.H.**, Otero, M., Composition and method to prevent pathogen transmission through altering saliva, US Patent App. 17/303,736, 2021. **Status: Docketed New Case - Ready for Examination**

Teaching

ESAMC College - Brazil (August 2016 – January 2019)

Overview: During this period, teaching activities were performed for Mechanical Engineering classes. Projects based on the acquired knowledge in the class were made. Interactive material was provided to help in the learning process. As a member of the faculty, periodic meetings to discuss improvements on the teaching/learning process were attended.

Main Features

Number of students per class	Class hour per week	Courses per semester	Teaching evaluation (1 - 6)
~60	~10	~3	5.2

Classes

Citations	Hours/Semester	Total hours
Transport Phenomena	80	80
Introduction to the Engineering	40	200
Resistance of Materials	40	80
Analytical Geometry	80	80
Calculus 3	80	240
Mathematics	80	160

Mentoring

Graduate Level

- ❖ George Loubimov
    - 🏛 University of Central Florida   📍 Orlando, FL, USA   📅 02/2019-08/2020
    - Support mentoring

- ❖ Caroline Anderson
    - 🏛 University of Central Florida   📍 Orlando, FL, USA   📅 02/2019-08/2020

Support mentoring

❖ Tadd Yeager
    🏛 University of Central Florida   📍 Orlando, FL, USA 🗓 02/2019-08/2020
    Support mentoring

❖ Reed Forehand
    🏛 University of Central Florida   📍 Orlando, FL, USA 🗓 02/2019-08/2020
    Support mentoring

Undergraduate Level

❖ Isadora Carneiro Araujo Souza
    🏛 ESAMC   📍 Uberlandia, MG, Brazil 🗓 02/2018-07/2018
    Mentoring Math Class Teaching Assistant

❖ Dana Mikkelsen
    🏛 University of Central Florida   📍 Orlando, FL, USA 🗓 06/2019-12/2019
    Co-mentoring Research Experiences for Undergraduates (REU)

Skills and Methodologies

Learning Management System	Active Learning Methods
Canvas	Team-based learning
Moodle	Project-based learning
Blackboard	Flipped room

Service

Administrative Activities

Role	Period
Graduate Student Representative - Department Council, UFU, Brazil	09/2015-04/2017
Graduate Student Representative - Graduate Council, UFU, Brazil	05/2017-06/2018

Organizations

- National Postdoctoral Association (2019-2021)
- APS-American Physical Society (2019-2021)
- AIAA-American Institute of Aeronautics and Astronautics (2019-2020)

Evaluation Committee

- Defense of final work of bachelor's in mechanical engineering: Lucas de Souza Meira (2018).

Session Chair

- NESF & ELS 2021, Session Dust Mitigation and Astronaut Health.

Revisions

Journals

- Physics of Fluids (2021)
- JADA (2021)
- Scientific Reports (2021)
- UCF Undergraduate Research Journal (2020)
- Physics of Fluids (2020)
- CFD Letters (2020)
- European Journal of Mechanics / B Fluids (2019)
- International Journal of Mechanical Sciences (2017)

Conferences

- Fluids Engineering Division Summer Meeting FEDSM 2021 (2021)

- COBEM (International Congress of Mechanical Engineering-Brazil) (2019)

- CONEM (National Conference of Mechanical Engineering-Brazil) (2014)

Proposals

- UCF Internal Revision: Project Call Request for White Paper/Prototype Proposal Number: TEES/JHTO-RPP-2021-001, University Consortium for Applied Hypersonics

Industry experience and Training

Internship BRF Company (2012)

Overview: Internship in the area of Planning and Maintenance Engineering of BRF Company, located at Uberlandia, Minas Gerais. The main activities were to monitor the maintenance plan and analyze the efficiency of the food freezing processing.

Training

Course	Time (hours)	Year
Preparing Tomorrow's Faculty	24	2021
Teaching and Learning in American Universities	16	2021
Fostering Excellence and Understanding in the Classroom	10	2020
First Steps in Research	2	2018
New Technologies of Learning	5	2018
Fundamentals of acoustic	4	2014
Submarine Engineering	7	2011
AutoCAD 2D	60	2010

Media Coverage and Outreach

➢ Droplet dispersion reduction during a sneeze
  ○ https://youtu.be/YwsUF9LU4Ng?t=205
➢ Self-Assembly Landing Pads for the Moon

- ○ https://www.ucf.edu/news/self-assembly-landing-pads-for-the-moon-ucf-researchers-are-working-on-it/