

Mahmoud M.A. Ahmed

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**PRESENT APPOINTMENT**

Sept 2023 – **Postdoctoral fellow**, Clean Combustion Research Center (CCRC), King  
present Abdullah University of Science and Technology (KAUST), Thuwal, Mekkah  
23955, Saudi Arabia.

**PREVIOUS APPOINTMENT**

Jan 2020 – **Assistant professor**, Department of engineering applications of Lasers (EAL),  
Aug 2023 National Institute of Laser Enhanced Sciences (NILES), Cairo University, Giza  
12613, Egypt.

**EDUCATION**

- 2020 **PhD**, Mechanical Engineering, University of Manitoba.  
Thesis title: Experimental Study of Burner Geometry Effect on the Coherent  
Structures, Flashback, and Flame Front Dynamics of Unconfined  
and Confined Partially Premixed Swirling Methane Flames.  
Supervisor: Prof. Madjid Birouk
- 2014 **MSc**, National Institute of Laser Enhanced Sciences (NILES), Cairo University,  
Egypt.  
Thesis title: Experimental Study of Highly Turbulent Partially Premixed Flames  
Using Advanced Laser Techniques.  
Supervisor: Prof. Mohy S. Mansour  
Co-advisors: Prof. Nahed Solouma – Prof. Ayman M. Elbaz
- 2008 **Bachelor of Mechanical Engineering**, Al-Azhar University, Egypt.  
Final year project: Design of Electromechanical System for a Hospital – HVAC  
section.

**TEACHING AND RESEARCH INTERESTS**

- Laser Diagnostics in Combustion
- Turbulent Combustion
- Combustion Instabilities
- Thermofluids

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## RESEARCH EXPERIENCE

- 2023 – present **Postdoctoral fellow**, King Abdullah University of Science and Technology, Saudi Arabia
- Designed the KAUST double swirl spray burner (KDSSB) based on modifying the design of the KAUST double swirl burner (KDSB).
  - Took part in a project titled “Characterization of NH<sub>3</sub>/CH<sub>4</sub>/air combustor fired by a double swirl stabilized burner from atmospheric to elevated pressure” funded by Aramco (5182-Aramco Project).
  - Analyzed the effect of pressure, coflowing air temperature, and cracking ratio on the structure of non-premixed NH<sub>3</sub>/H<sub>2</sub>/N<sub>2</sub> jet flames.
  - Analyzed the effect of pressure, coflowing air velocity, and fuel mole fraction on the lift-off height of the non-premixed laminar lifted nitrogen-diluted propane jet flames. Developed a new analytical method for obtaining the effective Schmidt number and correlated the operating conditions, and mixture composition and properties to the lift-off height.
  - Reviewed the recent experimental advances in flame stabilization and pollutant emissions of turbulent ammonia and blended ammonia flames.
- 2015-2020 **Doctoral student**, University of Manitoba, Canada
- Studied the effect of burner geometry on the coherent structures, flashback, and flame dynamics for confined and unconfined swirling partially premixed methane flames.
  - Prepared and conducted different experiments to achieve the objective of the study, such as particle image velocimetry (PIV), laser Doppler velocimetry (LDV), and Schlieren imaging technique.
  - Collected, analyzed, and discussed the experimental data and wrote six published journal papers and five conference paper.
  - Supervised and conducted some experiments for my laboratory colleagues.
  - Prepared a critical review of literature, with Mendeley desktop for bibliography, and appendices to write my PhD thesis examined by Prof. Ömer L. Gülder, University of Toronto, as an external examiner.
- 2009-2015 **Research assistant**, National Institute of Laser Enhanced Sciences, Cairo University, Egypt
- Studied the effect of Reynolds number, equivalence ratio, and partial premixing level on the flame stability of partially premixed flames stabilized in a concentric flow conical nozzle (CFCN) burner.
  - Prepared and conducted different experiments to achieve the objective of the study such as particle image velocimetry (PIV), and thermocouple-based temperature measurement.
  - Collected, analyzed, and discussed the experimental data and wrote one conference paper.
  - Co-supervised and conducted some experiments for my laboratory colleagues.
  - Prepared a critical review of literature for writing my M.Sc. thesis.

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- Successfully developed a laboratory-scale 40 W CO<sub>2</sub> laser for material processing and experiments.
- Developed and sold a device with an interactive image acquisition Matlab code for training the dermatologists on the proper hand speed in laser therapies.
- Took part in a project titled “Development of a new technique for screening and treatment of retinal disorders” funded by EU-Egypt innovation fund and as a part of the programming team, I developed new Matlab code for simulating the laser beam tracing through optics and human eye.

## TEACHING EXPERIENCE

2021-2023 **Lecturer**, National Institute of Laser Enhanced Sciences, Cairo University, Egypt.

*Courses:* Fundamentals of Optics (EAL 502) – Optical Instrumentation (EAL 506) – Applied Project (EAL 508) - Computational Techniques (EAL 509) – Advanced Measurement Techniques (EAL 708).

- Graded postgraduate students’ term test booklets and assignments.
- Provided guidance to the students during the tutorials and office hours on how to solve difficult problems.
- Invigilated the final year examinations for all students.

2016-2020 **Teaching assistant**, Faculty of Engineering, University of Manitoba, Canada

*Courses:* Thermodynamics (MECH 2202) - Kinematics and Dynamics (MECH 3482) - Renewable Energy (MECH 4692)

- Graded undergraduate students’ term test booklets and assignments where the number of the students per semester ranges from 25 to 80 students.
- Provided guidance to the students during the tutorials and office hours on how to solve difficult problems.
- Invigilated the final year examinations for all students.

2010-2013 **Teaching assistant**, National Institute of Laser Enhanced Sciences, Cairo University, Egypt

*Courses:* Experimental Techniques in Laser Engineering II (EAL 605) - Laser Engineering I (EAL 503) - Laser Physics I (EAL 501)

- Conducted the experiments and explained the concepts of each technique for 15 postgraduate students.
- Provided guidance to the students during my office hours on how to comprehend the experiments.
- Demonstrated and explained how to solve problems of this course and comprehend the physics behind the lasers technology

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## **PUBLICATIONS, PEER REVIEWED**

A.M. Albalawi, A.M. Elbaz, M.M.A. Ahmed, Z.O. Hassan, W.L. Roberts, “Investigation of the near-field structure and stability of non-premixed NH<sub>3</sub>/H<sub>2</sub>/N<sub>2</sub> jet flames at various pressure and co-flow conditions”, Proceedings of the Combustion institute 40 (1-4) (2024) 105700.

M.M.A. Ahmed, L. Xu, X-S. Bai, Z.O. Hassan, M. Abdullah, J. Sim, E. Cenker, W.L. Roberts, A.M. Elbaz, “Flame stabilization and pollutant emissions of turbulent ammonia and blended ammonia flames: A review of the recent experimental and numerical advances”, Fuel Communications 20 (2024) 100127.

H.M. Al-Bulqini, M.M.A. Ahmed, A.M. Elbaz, M.F. Zayed, W.L. Roberts, M. Juddoo, A.R. Masri, M.S. Mansour, “The effect of mixture inhomogeneity and turbulence on the flame front curvature and flame surface density of turbulent planar flames of natural gas”, Fuel 360 (2024) 130620.

A.M. Khedr, A.M. Elbaz, M.M.A. Ahmed, M.F. Zayed, M.S. Senosy, H. Kayed, S. Kruse, Y. Ren, H. Pitsch, M.S. Mansour, “The mixing field and flame structure near the reaction zone of turbulent planar flames at different levels of mixture inhomogeneity”, Fuel 358 (2024) 130216.

R.M. Abdelazeem, M.M. A. Ahmed, S.H. Elnaby, M. Agour, “Adaptive phase control of a phase-only spatial light modulator using the Shack-Hartmann wavefront sensor”, Applied Optics 63 (2024) G54-G62.

A.M. Elbaz, M.M.A. Ahmed, A. M. Albalawi, W.L. Roberts, “Mixing and flame structure study of inverse swirl diffusion flames”, Experimental Thermal and Fluid Science 147 (2023) 110946.

R.M. Abdelazeem, M.M.A. Ahmed, M. Agour, “Adaptive Shack-Hartmann wavefront system with extended dynamic range for lens characterization”, SPIE Proceedings Volume 12618, Optical Measurement Systems for Industrial Inspection XIII; 126182D (2023).

R.M. Abdelazeem, M.M.A. Ahmed, S.H. Elnaby, M. Agour, “Improving the phase modulation of spatial light modulator using Shack-Hartmann wavefront sensor”, SPIE Proceedings Volume 12618, Optical Measurement Systems for Industrial Inspection XIII; 126182Q (2023).

R.M. Abdelazeem, M.M.A. Ahmed, “Holographic visualization of normal and cancer lymphocytes using phase-only spatial light modulator” IEEE Xplore 2023

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5th Novel Intelligent and Leading Emerging Sciences Conference (NILES), Giza, Egypt, 2023, pp. 48-50.

R.M. Abdelazeem, M.M.A. Ahmed, M. Agour, “Characterization of thick and contact lenses using an adaptive Shack–Hartmann wavefront sensor: Limitations and solutions”, *Optik* 283 (2023) 170922.

A.M. Elbaz, M.S. Mansour, B.M. Akoush, M. Juddoo, A.M. Khedr, H.M. Al-Bulqini, M.F. Zayed, M.M.A. Ahmed, W.L. Roberts, A.R. Masri, “Detailed investigation of the mixing field and stability of natural gas and propane in highly turbulent planar flames”, *Fuel* 309 (2022) 122222.

M.M.A. Ahmed, M. Birouk, “Acoustic Dampers effects on the Characteristics of Confined Swirling Partially Premixed Methane Flames”, *Flow, Turbulence and Combustion* (2020). <https://doi.org/10.1007/s10494-020-00194-2>.

M.M.A. Ahmed, M. Birouk, “Mixing tube length effect on the stability of confined swirling partially premixed methane flames off a concentric flow conical nozzle burner”, *Combustion Science and Technology* <https://doi.org/10.1080/00102202.2020.1761800>

M.M.A. Ahmed, M. Birouk, “Effect of fuel nozzle geometry on swirling partially premixed methane flames”, *ASME Journal of Engineering for Gas Turbines and Power* GTP-19-1067 142 (3)(2020) 031009.

M.M.A. Ahmed, M. Birouk, “Burner geometry effect on coherent structures and acoustics of a confined swirling partially premixed methane flame”, *Experimental Thermal and Fluid Science* 105 (2019) 85-99.

M. Broumand, M.M.A. Ahmed, M. Birouk, “Experimental investigation of spray characteristics of a liquid jet in a turbulent subsonic gaseous crossflow”, *Proceedings of the Combustion institute* 37 (3)(2019) 3237-3244.

M.M.A. Ahmed, M. Birouk, “Effect of fuel nozzle geometry and airflow swirl on the coherent structures of partially premixed methane flame under flashback conditions”, *Experimental Thermal and Fluid Science* 99 (2018) 304-314.

## **PUBLICATIONS, NON-PEER REVIEWED**

A.A. Tawfik, M.M.A. Ahmed, O. Hamdy, S.H. Elnaby, “Computer-assisted training tool for evaluating operator’s delivery skills during laser skin treatment”, *Education and Training in Optics & Photonics Conference 2021, OSA Technical Digest (Optical Society of America, 2021)*, paper F2A.2.

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R.M. Abdelazeem, M.M.A. Ahmed, O. Hamdy, “Monitoring the optical diffuse transmittance of skin during thermos-hydrotherapy via spatial frequency domain imaging: A pilot study”, Biophotonics Congress 2021, OSA Technical Digest (Optical Society of America, 2021), paper JW1A.9.

M.M.A. Ahmed, M. Birouk, “Effect of partial premixing level on PVC amplitude and acoustics of confined swirling partially premixed flames”, in CICS Technical Meeting, British Columbia, Canada (2019).

M.M.A. Ahmed, M. Birouk, “Experimental study of the effect of acoustic dampers on the stability of confined swirling partially premixed flames”, in CICS Technical Meeting, British Columbia, Canada (2019).

M.M.A. Ahmed, M. Birouk, “Effect of mixing length and fuel nozzle geometry on coherent structures and acoustics of partially premixed swirling flame”, in CICS Technical Meeting, Ontario, Canada (2018).

A. Al-Abbasi, M.M.A. Ahmed, M. Saediamiri, M. Birouk, “Effect of burner geometry and swirl strength on flame stability of premixed biogas flames”, in CICS Technical Meeting, Montréal, Canada (2017).

M.M.A. Ahmed, M. Birouk, “Effect of burner geometry on the stability of partially premixed swirling flames,” in CICS Technical Meeting, Ontario, Canada (2016).

M.S. Mansour, M.M.A. Ahmed, A. M. Elbaz, and N. Solouma, “Partially premixed flames in a concentric flow conical nozzle burner with turbulence generator,” in The 9<sup>th</sup> Mediterranean Combustion Symposium, Rhodes, Greece(2015).

## POSTERS

M.S. Mansour, A.M. Elbaz, W.L. Roberts, M.F. Zayed, M.M.A. Ahmed, M.S. Senosy, “High speed imaging of the reaction zone of highly stabilized turbulent partially premixed methane flames in a concentric flow conical nozzle burner”, 37<sup>th</sup> International Symposium on Combustion, Dublin, Ireland, 29 July – 3 August 2018.

## MEMBERSHIPS

2020-present **Member**, Combustion Institute - Egyptian Section  
2016-2020 **Member**, Combustion Institute - Canadian Section (CICS)  
2016-2020 **Member**, The American Society of Mechanical Engineers (ASME)

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## AWARDS

July 2016 International Graduate Student Scholarship (IGSS), University of Manitoba, Canada  
July 2015 International Graduate Student Entrance Scholarship (IGSES), University of Manitoba, Canada  
June 2011 Best Teaching Assistant award, National Institute of Laser Enhanced Sciences, Cairo University, Egypt.  
September 2008 Highest GPA award, Faculty of Engineering, Al-Azhar University, Egypt.

## LANGUAGES

Excellent at English and Fluent in Arabic (spoken and written)

## TECHNICAL SKILLS

**Software** Matlab 2023 - AutoCAD 2023 - Tecplot 360 - MS Office 365 - Dantec Dynamics DynamicStudio v4.1 - Hourly Analysis Program (HAP v5.1) HVAC - Bibliographic database (Mendeley desktop) – Adobe Illustrator CS6.

**Techniques** Particle image velocimetry (PIV) - Laser Doppler Velocimetry (LDV) - Schlieren imaging – Thermocouple-based temperature measurement – Phase Doppler Interferometry (PDI).

## REFERENCES

Prof. William L. Roberts (PI)  
Clean Combustion Research Center (CCRC), King Abdullah University of Science and Technology (KAUST), Thuwal, Makkah 23955, Saudi Arabia.  
[william.roberts@kaust.edu.sa](mailto:william.roberts@kaust.edu.sa)

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Mechanical Engineering Department, The American University in Cairo, AUC Avenue, P.O. Box 74, New Cairo 11835, Egypt  
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