Balaji Mohan | Curriculum Vitae

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Teaching Interests

Engineering Thermodynamics, Fluid Mechanics, Heat and mass Transfer, Combustion, Heating Ventilating and Air-conditioning (HVAC), Energy Engineering, Renewable and Sustainable Energy, Thermal Design, Heat Exchangers, Gas Dynamics.

Research Interests

Fuel spray modelling, Injector nozzle flow modelling, Two phase flow modelling, Spray combustion, Fuel spray visualization, Combustion modelling of different fuels, Fuel injection strategies, Optimization of engine performance and emissions, Image processing, Thermo–fluid systems modelling, Air Conditioning and Mechanical Ventilation (ACMV), Indoor Air Quality (IAQ), Heat Transfer.

Education

○ **Ph.D.** **Singapore**
Mechanical Engineering, National university of Singapore *2011 − 2015*
Thesis Topic: *Performance and Emission Optimization of CIDI Engine through various Fuel Injection Strategies*
Advisors: Asoc. Prof. Wenming Yang and Prof. SiawKiang Chou
CAP: 4.42 out of 5.0

○ **B.E** **India**
Mechanical Engineering, Anna university *2004 − 2008*
Aggregate: 89.48%

Professional Experience

○ **Lab Scientist I** **Saudi Arabia**
Saudi Aramco *Jan 2020 − present*

Project Title – AI driven engine combustion system optimization, FUELCOM, MZEV

- Development of machine learning (ML) and artificial intelligence (AI) combined genetic algorithm (GA) codes to optimize IC engine performance and emissions.
- Development of intake and exhaust manifolds of the Mobile Zero Emission Vehicle (MZEV) project through CFD.
- Spray characterization of super-, trans- and sub-critical sprays under isobaric conditions.
- Development of isobaric high-pressure combustion concept through CFD.
- Development of LD and HD pre-chamber combustion engines through CFD.
- Fundamental understanding of ducted fuel spray and its reduced NOx and soot emissions through CFD.

○ **Post-Doctoral Fellow**   **Saudi Arabia**
 Clean Combustion Research Centre (CCRC), KAUST   *May 2017 – Dec 2019*
 Project Title – FUELCOM
 Supervisors – Prof. William L. Roberts and Prof. Hong G. Im

- Spray characterization of both light-duty and heavy-duty injectors in constant volume chamber through DBI and PLIEF techniques.
- Soot characterization using LII technique in constant volume chamber.
- Design and setting up of high pressure (300 bar) and high-temperature constant volume vessel.
- Spray modeling using RANS method in Converge CFD package.
- Spray modeling using LES method in OpenFOAM platform.
- Simulation of Super-knock event in gasoline engines.
- Simulation high pressure (300 bar) isobaric advanced combustion in Combination with the Double Compression Expansion Engine (DCEE) Concept.
- Modeling pre-chamber turbulent jet engine combustion.
- Super-critical spray characterization and investigation of super-critical oxy-fuel combustion flame at the ultra high-pressure environment.
- Simulation of super-critical sprays using an advanced and accurate cubic equation of states.
- Dissemination of research finding through half-yearly reports to the funding agency and in international peer-reviewed journals and conferences.
- This project was in collaboration with Saudi Aramco, Prof. Jeffrey Naber from Michigan Technological University (MTU), Prof. Hrvoje Jasak from University of Zagreb, Prof. Christopher Rutland from University of Wisconsin.
- Contribution to Engine Combustion Network (ECN).

○ **Research Fellow**   **Singapore**
 Mechanical Engineering, National university of Singapore   *April 2015 – April 2017*
 Project Title – An innovative air treatment system for improved air quality, reduced humidity load and energy efficient ACMV (Air Conditioning and Mechanical Ventilation)
 Supervisor – Assoc. Prof. Chua Kian Jon, Ernest

- Conducted experiments and numerical simulation on a novel air treatment system.
- Engaged in design and development of research activities.
- Engaged in the development of a proposal for research funding.
- Mentored and assisted the undergraduate students for their final year project.
- Dissemination of research finding in international journals and conferences.
- Carried out administrative and management work associated with the research project.

○ **Product Engineer**   **India**
 Engineering and Development, Delphi–TVS Diesel Systems Ltd.   *June 2008 – December 2010*

Project Title – Development of S325 engine to meet TREM–IIIA emission norms
- Design, testing and calibration of fuel injection equipment for Tractor applications.
- Optimized engine performance and emissions to meet emission standards.
- Provide customer support and field apprehension solution yielding.
- Conducted DOE, DFMEA and design review of application development in accordance with ISO/TS 16949.
- Part of a CFT team for product development.
- Responsible to obtain Homologation of emission standards.

Research Experience

Artificial Intelligence and Data Science
○ Optimization of engine combustion system using machine learning and evolutionary-based algorithms.
○ Choosing a better machine-learning algorithm to suit the problem or building upon ensembled learning algorithms tailored to a specific problem to improve the accuracy of the predictions.
○ Development of generalized machine learning algorithm to use both Computational and experimental datasets to obtain useful insights, improve the understanding, and further speed up the optimization for future products.

Engine optimization
○ Investigated engine performance and emissions fueled by different fuels like biodiesel, emulsion fuel, and blend fuels.
○ Gained knowledge of testing engines following ISO standards and applying appropriate correction factors for performance and emissions.
○ The influence of injection strategies was studied in detail and its effect on emissions and combustion characteristics were established.

Fuel spray visualization
○ Designed and conceived an experimental set–up encompassing a high-pressure spray chamber and visualization accessories at NUS for a fundamental understanding of the spray development process.
○ Macroscopic spray characterization of different fuels under high injection pressure and ambient density conditions using a high-speed camera.
○ Spray momentum flux measurement set–up was established to measure and quantify the spray momentum and injection rate.
○ Long tube Bosch method was established as an alternate method to quantify the injection rate at one-tenth of the cost of the commercial rig.
○ Design of high pressure (300 bar) and high-temperature constant volume chamber at KAUST spray Lab.
○ study of super-critical sprays and super-critical oxy-fuel combustion for the Allam cycle.

Combustion Modeling

○ Experienced in 3D CFD modeling of combustion and emissions of different fuels and the prediction of essential thermophysical properties for various fuels.

○ Studied the detailed chemical reaction mechanism of biodiesel fuel and involved in reducing reaction mechanisms.

○ Investigated the effects of various fuel injection strategies for optimizing performance and emissions of biodiesel and blend fuels.

○ Modeling of high pressure (300 bar) isobaric combustion in a combination of the Double Compression Expansion Engine (DCEE) concept.

○ Modeling of super-knock event and developing abating techniques to prevent engine damage from knocking.

○ Modeling pre-chamber turbulent jet engine combustion.

Fuel spray modeling

○ Developed a new hybrid spray model by combining cavitation, Kelvin-Helmholtz, and Rayleigh-Taylor sub-models to improve the prediction of spray characteristics.

○ This new model was implemented in KIVA–4 CFD code. The model was extensively validated with experimental spray results obtained from both literature and in-house experiments.

○ Using the new hybrid models, the spray characteristics of different fuels have been evaluated and demonstrated.

○ Spray-G gasoline spray modeling using the Converge CFD package.

Two-phase nozzle flow modeling

○ Modeled cavitation phenomenon in diesel injector nozzles using a two-phase cavitation model.

○ A detailed parametric study has been carried out to identify the factors affecting its inception.

○ Modeled flash boiling phenomenon in gasoline sprays using transient needle motion and pressure boundary conditions.

Micro–reactor modeling

○ Involved in the development of energy-efficient novel heterogeneous gaseous T-junction microreactor by utilizing inlet flow pulsations.

○ By feeding the same amount of reactant and same pumping power/parasitic loads, the new design was able to run two microreactors and could achieve almost the same level of performance as that of a steady flow microreactor with an expense of one microreactor.

Indoor air quality (IAQ) and Energy Efficient ACMV

○ Abatement of volatile organic compounds (VOCs) with ozone.

○ Mitigate the level of CO_2 and enrich the oxygen content in the recirculated air.

○ Increase the amount of recirculated air, thereby reducing fresh air intake to reduce humidity load and improve the energy efficiency of the air handling unit (AHU) by up to 30%.

○ Develop a ready to deploy plug and play system using the cutting edge technology enrooted from this project to improve the energy efficiency of the existing air conditioning

system.

Teaching Experience

Teaching Assistant

○ ME2121 - Engineering Thermodynamics (NUS)   Sem – I, 2014 – 2015
○ ME3122 - Heat Transfer (NUS)   Sem – I, 2012 – 2013 and Sem – I, 2013 – 2014
○ ME2135 - Fluid Mechanics–II (NUS)   Sem – I, 2011 – 2012

Lab Instructor

○ ME2121E - Engineering Thermodynamics (NUS)   Sem – I, 2014 – 2015
○ Spray simulations - Clean Combustion Winter School (KAUST)   Jan–Feb, 2018
○ Spray experiments - Clean Combustion Winter School (KAUST)   Jan–Feb, 2018
○ Spray simulations - Clean Combustion Winter School (KAUST)   Jan–Feb, 2019
○ Spray experiments - Clean Combustion Winter School (KAUST)   Jan–Feb, 2019

Undergraduate Research Mentor

○ Final Year Project (FYP)   2012 – 2017

- Mentored 4 undergraduate students in modeling combustion process using KIVA–4 and cavitation in injector nozzles in Fluent CFD for their final year projects. (NUS)
- **Co-supervised** an undergraduate student for his final year project titled *"Studying an innovative air treatment system for buildings"*. (NUS)
- Mentored an undergraduate student on "*Analyzing of ozone air treatment system for air conditioning application.*" (NUS)

Masters and Doctoral Research Mentor

○ Thesis Research Mentor   2017 – present

- Co-supervised a master student along with Dr. Abdul Gani Abdul Jameel, Assistant professor from King Fahd University of Petroleum and Minerals (KFUPM) on master thesis titled "*Predicting physical properties of oxygenated transportation fuels using machine learning*"
- Mentored one Ph.D. student on the experimental investigation of flash boiling phenomenon in gasoline sprays. *(Supervisor - Prof. William L. Roberts)*
- Mentored one Master student on the design of high pressure (300 bar) and high-temperature constant volume combustion chamber. *(Supervisor - Prof. William L. Roberts)*
- Mentored one Masters and one Ph.D. student on high pressure (300 bar) isobaric combustion modeling. *(Supervisor - Prof. Hong G. Im)*
- Mentored one Master student on pre-chamber turbulent jet engine combustion modeling. *(Supervisor - Prof. Hong G. Im)*
- Mentored one Ph.D. student on modeling super-knock in gasoline engines and developing abating techniques. *(Supervisor - Prof. Hong G. Im)*

Publication List

Source	No. of documents	Total Citations	h-index	i10-index
Scopus	68	1622	23	–
Google Scholar	72	2031	24	39

PhD Thesis

○ **B Mohan**. *Performance and Emission Optimization of CIDI Engine through various Fuel Injection Strategies.* National University of Singapore, 2015. *Thesis*.

Book Chapters

1. **B Mohan**, P Pal, J Badra, Y Pei, S Som. *Introduction* in *Artificial Intelligence and Data Driven Optimization of Internal Combustion Engines*, edited by J Badra, P Pal, Y Pei, S Som, Elsevier Inc., 1–23, 2022. *DOI: 10.1016/B978-0-323-88457-0.00002-3*.

Patents

1. **B Mohan**, J Badra. *Method for automated ensemble machine learning using hyperparameter optimization. filed on January 7, 2022. US patent application No. 17/647375.*

2. **B Mohan**, J Chang. *Methods and systems for fuel design using machine learning. filed on April 25, 2023. US patent application No. 18/306610.*

Refereed Journal Articles

Underline - Corresponding Author

1. **B Mohan**, J Badra. *A novel automated machine learning framework for piston engine optimization.* Applications in Energy and Combustion Science, 13, 100106, 2023. *DOI: 10.1016/j.jaecs.2022.100106*

2. **B Mohan**, J Badra. *A novel automated SuperLearner using a genetic algorithm based hyperparameter optimization.* Advances in Engineering software, 175, 103358, 2023. *DOI: 10.1016/j.advengsoft.2022.103358* [SCIE]

3. M Silva, **B Mohan**, J Badra, A Zhang, P Hlaing, E Cenker, A AlRamadan, HG. Im. *DoE-ML guided optimization of an active pre-chamber geometry using CFD.* International journal of Engine Research. 2022. *(just accepted) DOI: 10.1177/1468087422113527* [SCIE]

4. H Aljabri, M Silva, MB Houidi, X Liu, M Allehaibi, F Almatrafi, A AlRamadan, **B Mohan**, E Cenker, HG. Im. *Comparative study of spark-ignited and pre-chamber hydrogen-fueled engine - A computational approach.* Energies. 15(23):8951, 2022. *DOI: 10.3390/en15238951* [SCIE]

5. B Aljohani, MB Houidi, J Du, A Dyuisenakhmetov, **B Mohan**, A AlRamadan, WL Roberts. *Characterization of the Rate of Injection of Diesel Solenoid Injectors Operated in the Multiple Injection Strategy: A Comparison of the Spray Momentum and Bosch Tube Methods.* Frontiers in Mechanical Engineering *(Special issue on Advances in Fuel Injection Systems)*. 2022. *DOI: 10.3389/fmech.2022.889255* [ESCI]

6. J Sim, **B Mohan**, J Badra. *Co-optimization of Piston Bowl and Injector for Light-Duty GCI Engine Using CFD and ML.* Fuel *(Special issue on AI in Energy Industry).* 125455, 2022. *DOI: 10.1016/j.fuel.2022.125455* [SCI]

7. **B Mohan**, AS Ramadan, Y Qahtani, Y Viollet, J Badra. *Development cycle time reduction using design*

of experiments and machine learning-based optimization framework. Fuel *(Special issue on AI in Energy Industry).* 124671, 2022. *DOI: 10.1016/j.fuel.2022.124671* [SCI]

8. J Du, **B Mohan**, J Sim, T Fang, WL Roberts. *Study of spray structure under flash boiling conditions using 2phase-SLIPI.* Experiments in Fluids. 62(1), 2020. *DOI: 10.1007/s00348-020-03123-1* [SCIE]

9. X Liu, H Aljabri, **B Mohan**, R Babayev, J Badra, B Johansson, HG Im. *A numerical investigation of isobaric combustion strategy in a compression ignition engine.* International Journal Engine Research. 22(11): 3372 − 3390, 2020. *DOI: 10.1177/1468087420970376* [SCIE]

10. X Liu, **B Mohan**, HG Im. *Numerical Investigation of the Free and Ducted Fuel Injection Strategies under Compression Ignition Condition.* Energy & Fuels. 34(11): 14832 − 14842, 2020. *DOI: 10.1021/acs.energyfuels.0c02757* [SCI]

11. **B Mohan**, J Badra, J Sim, HG Im. *Coupled in-nozzle flow and spray simulation of Engine Combustion Network (ECN) Spray-G injector.* International Journal Engine Research. 22(9): 2982 − 2996, 2020. *DOI: 10.1177/1468087420960612* [SCIE]

12. J Du, **B Mohan**, J Sim, T Fang, J Chang, WL Roberts. *Influence of flash boiling on spray morphology using a prototype injector for gasoline compression ignition (GCI) application.* Atomization and Sprays, 30(5):351 − 369. 2020. *DOI: 10.1615/AtomizSpr.2020034561* [SCIE]

13. J Du, G Zang, **B Mohan**, R Idoughi, J Sim, T Fang, P Wonka, W Heidrich, WL Roberts. *Study of spray structure from non-flash to flash boiling conditions with space-time tomography.* Proceedings of the Combustion Institute. 38(2):3223 − 3231, 2020. *DOI: 10.1016/j.proci.2020.06.171* [SCIE]

14. J Du, **B Mohan**, J Sim, T Fang, J Chang, WL Roberts. *A comprehensive study of spray and combustion characteristics of a prototype injector for gasoline compression ignition (GCI) application.* Fuel. 118144, 2020. *DOI: 10.1016/j.fuel.2020.118144* [SCI]

15. CK Mohapatra, DP Schmidt, BA Sforozo, KE Matusik, Z Yue, CF Powell, S Som, **B Mohan**, HG Im, J Badra, M Bode, H Pitsch, D Papoulias, K Neroorkar, S Muzaferija, P Marti-Aldaravi, M Martinez. *Collaborative investigation of the internal flow and near-nozzle flow of an eight-hole gasoline injector (Engine Combustion Network Spray G).* International Journal of Engine Research. 2020. *DOI: 10.1177/1468087420918449* [SCIE]

16. J Du, **B Mohan**, J Sim, T Fang, WL Roberts. *Auto-ignition characteristics of high-reactivity gasoline fuel using a gasoline multi-hole injector.* Experimental Thermal and Fluid Science. 109993, 2020. *DOI: 10.1016/j.expthermflusci.2019.109993* [SCIE]

17. J Du, **B Mohan**, J Sim, T Fang, WL Roberts. *Study of spray collapse phenomenon at flash boiling conditions using simultaneous front and side view imaging.* International Journal of Heat and Mass Transfer. 118824, 2020. *DOI: 10.1016/j.ijheatmasstransfer.2019.118824* [SCIE]

18. J Du, **B Mohan**, J Sim, T Fang, WL Roberts. *Experimental and analytical study on liquid and vapor penetration of high-reactivity gasoline using a high-pressure gasoline multi-hole injector.* Applied Thermal Engineering. 163: 114187, 2019. *DOI: 10.1016/j.applthermaleng.2019.114187* [SCIE]

19. J Du, **B Mohan**, J Sim, T Fang, WL Roberts. *Macroscopic non-reacting spray characterization of gasoline compression ignition fuels in a constant volume chamber.* Fuel. 255: 115818, 2019. *DOI: 10.1016/j.fuel.2019.115818* [SCI]

20. Y Li, A Alfazazi, **B Mohan**, EA Tingas, J Badra, SM Sarathy. *The Development of a Highly Reduced Four-Component (Toluene/n-Heptane/iso-Octane/Ethanol) Gasoline Surrogate Model.* Fuel. 247: 164–178, 2019. *DOI: 10.1016/j.fuel.2019.03.052* [SCI]

21. **B Mohan**, J Du, J Sim, WL Roberts. *Hydraulic characterization of high pressure gasoline multi-hole injector.*

Flow measurement and Instrumentation. 64: 133–141, 2017. *DOI: 10.1016/j.flowmeasinst.2018.10.017* [SCIE]

22. X Cui, **B Mohan**, MR Islam, K̲J̲ C̲h̲u̲a̲. *Investigating the energy performance of an air treatment incorporated cooling system for hot and humid climate.* Energy and Buildings 151: 217–227, 2017. *DOI: 10.1016/j.enbuild.2017.06.059* [SCI]

23. KL Tay, W̲ Y̲a̲n̲g̲, F Zhao, W Yu, **B Mohan**. *A numerical study on the effects of boot injection rate-shapes on the combustion and emissions of a kerosene-diesel fueled direct injection compression ignition engine.* Fuel 203: 430–444, 2017. *DOI: 10.1016/j.fuel.2017.04.142.* [SCI]

24. HF Ridgway, **B Mohan**, X Cui, K̲J̲ C̲h̲u̲a̲, MR Islam. *Molecular Dynamics Simulation of Gas-Phase Ozone Reactions with Sabinene and Benzene.* Journal of Molecular Graphics and Modelling 74: 241–250. *DOI: 10.1016/j.jmgm.2017.04.020.* [SCI]

25. KL Tay, W̲ Y̲a̲n̲g̲, L Jing, D Zhou, W Yu, F Zhao, SK Chou , **B Mohan**. *Numerical investigation on the combustion and emissions of a kerosene-diesel fueled compression ignition engine assisted by ammonia fumigation.* Applied Energy 204: 1476–1488. *DOI: 10.1016/j.apenergy.2017.03.100.* (Transformative Innovations for a Sustainable Future (Special issue of ICAE2016)). [SCI]

26. X Cui, **B Mohan**, MR Islam, SK Chou, K̲J̲ C̲h̲u̲a̲. *Energy performance evaluation and application of an air treatment system for conditioning building spaces in tropics.* Applied Energy 204: 1500–1512. *DOI: 10.1016/j.apenergy.2017.03.067.* (Transformative Innovations for a Sustainable Future (Special issue of ICAE2016)). [SCI]

27. KL Tay, W̲ Y̲a̲n̲g̲, F Zhao, W Yu, **B Mohan**. *Numerical investigation on the combined effects of varying piston bowl geometries and ramp injection rate-shapes on the combustion characteristics of a kerosene-diesel fueled direct injection compression ignition engine.* Energy Conversion and Management 136: 1–10, 2017. *DOI: 10.1016/j.enconman.2016.12.079.* [SCIE]

28. W Yu, W̲ Y̲a̲n̲g̲, F Zhao, D Zhou, KL Tay, **B Mohan**. *Development of a Three-step Hybrid Simulation Approach (THSA) for Engine Combustion Investigation Coupled with a Multistep Phenomenon Soot Model and Energy Balance Analysis.* Applied Energy 185, Part 1: 482-–496, 2017. *DOI: 10.1016/j.apenergy.2016.10.137* [SCI]

29. KL Tay, W̲ Y̲a̲n̲g̲, F Zhao, W Yu, **B Mohan**. *Effects of triangular and ramp injection rate-shapes on the performance and emissions of a kerosene-diesel fueled direct injection compression ignition engine: A numerical study.* Applied Thermal Engineering 110: 1401–1410, 2017. *DOI: 10.1016/j.applthermaleng.2016.09.072* [SCI]

30. X Cui, MR Islam, **B Mohan**, K̲J̲ C̲h̲u̲a̲. *Developing a performance correlation for counter-flow regenerative indirect evaporative heat exchnagers with experimental validation.* Applied Thermal Engineering 108: 774–784, 2016. *DOI: 10.1016/j.applthermaleng.2016.07.189* [SCI]

31. KL Tay, W̲M̲ Y̲a̲n̲g̲, **B Mohan**, D Zhou, W Yu, F Zhao. *Development of a reduced kerosene-diesel reaction mechanism with embedded soot chemistry for diesel engines.* Fuel 181: 926–934, 2016. *DOI:10.1016/j.fuel.2016.05.029.* [SCI]

32. W Yu, W̲ Y̲a̲n̲g̲, KL Tay, **B Mohan**, F Zhao, Y Zhang. *Macroscopic spray characteristics of kerosene and diesel based on two different piezoelectric and solenoid injectors.* Experimental Thermal and Fluid Science 76: 12–23, 2016. *DOI: 10.1016/j.expthermflusci.2016.03.008..* [SCIE]

33. **B Mohan**, W̲M̲ Y̲a̲n̲g̲, W Yu, KL Tay. *Numerical analysis of spray characteristics of dimethyl ether and diethyl ether fuel.* Applied Energy Volume 185, Part 2: 1403-–1410, 2017. *DOI:10.1016/j.apenergy.2016.01.128.* (Clean, Efficient and Affordable Energy for a Sustainable

Future (Special issue of ICAE2015: Part I)) [SCI]

34. W Yu, WM Yang, **B Mohan**, KL Tay, F Zhao, Y Zhang. *Macroscopic spray characteristics of Wide Distillation Fuel (WDF).* Applied Energy 185 Part 2: 1372-–1382, 2017. *DOI: 10.1016/j.apenergy.2015.12.051.* (Clean, Efficient and Affordable Energy for a Sustainable Future (Special issue of ICAE2015: Part II)) [SCI]

35. X Cui, MR Islam, **B Mohan**, KJ Chua. *Theoretical analysis of a liquid desiccant based indirect evaporative cooling system.* Energy 95: 303–312, 2015. *DOI: 10.1016/j.energy.2015.12.032.* [SCI]

36. KL Tay, WM Yang, **B Mohan**, H An, D Zhou, W Yu. *Development of a robust and compact kerosene–diesel reaction mechanism for diesel engines.* Energy Conversion and Management 108: 446-458, 2016. *DOI: 10.1016/j.enconman.2015.11.018.* [SCIE]

37. **B Mohan**, WM Yang, KL Tay, W Yu, SK Chou. *Numerical investigation on the effects of injection rate shaping on combustion and emission characteristics of biodiesel fueled CI engine.* Applied Energy 160: 737–745, 2015. *DOI: 10.1016/j.apenergy.2015.08.034.* (Transition of Clean Energy Systems and Technologies towards a Sustainable Future (Special Issue of ICAE2014: Part I)) [SCI]

38. **B Mohan**, KL Tay, WM Yang, KJ Chua. *Development of a skeletal multi-component fuel reaction mechanism based on decoupling methodology.* Energy Conversion and Management 105: 1223–1238, 2015. *DOI: 10.1016/j.enconman.2015.08.060.* [SCIE]

39. **B Mohan**, WM Yang, KL Tay, W Yu. *Experimental study of spray characteristics of biodiesel derived from Waste cooking oil.* Energy Conversion and Management 88:622–632, 2014. *DOI: 10.1016/j.enconman.2014.09.013.* [SCIE]

40. **B Mohan**, J Puqing, AP Sasmito, JC Kurnia, SV Jangam, AS Mujumdar. *Energy efficient novel heterogeneous gaseous T-junction micro-reactor design utilizing inlet flow pulsation.* Industrial & Engineering Chemistry Research 53:18699–18710, 2014. *DOI: 10.1021/ie500797f.* (*Ganapati D. Yadav Festschrift special issue*) [SCI]

41. **B Mohan**, WM Yang, KL Tay, W Yu. *Macroscopic spray characterization under high ambient density conditions.* Experimental Thermal and Fluid Science, 59:109–117, 2014. *DOI: 10.1016/j.expthermflusci.2014.08.003.* [SCIE]

42. **B Mohan**, WM Yang, V Raman, V Sivasankaralingam, SK Chou. *Optimization of biodiesel fueled engine to meet emission standards through varying nozzle opening pressure and static injection timing.* Applied Energy, 130:450–457, 2014. *DOI: 10.1016/ j.apenergy.2014.02.033.* (*Special Issue: The 5th International Conference on Applied Energy (ICAE2013), Part I: Energy innovations for a sustainable world*) [SCI]

43. **B Mohan**, WM Yang, W Yu. *Effect of internal nozzle flow and thermo-physical properties on spray characteristics of methyl esters.* Applied Energy, 129:123–134, 2014. *DOI: 10.1016/j.apenergy.2014.04.109.* [SCI]

44. **B Mohan**, WM Yang, SK Chou. *Cavitation in Injector Nozzle Holes–A Parametric Study.* Engineering Applications of Computational Fluid Mechanics, 8(1):70–81, 2014. *DOI: 10.1080/19942060.2014.11015498.* [SCIE]

45. **B Mohan**, WM Yang, SK Chou. *Development of an accurate cavitation coupled spray model for diesel engine simulation.* Energy Conversion and Management, 77:269–277, 2014. *DOI: 10.1016/j.enconman.2013.09.035.* [SCIE]

46. **B Mohan**, WM Yang, SK Chou. *Fuel injection strategies for performance improvement and emissions reduction in compression ignition engines-A review.* Renewable and Sustainable Energy Reviews, 28:664–676, 2013. *DOI: 10.1016/ j.rser.2013.08.051.* [SCI]

47. <u>WM Yang</u>, H An, SK Chou, KJ Chua, **B Mohan**, V Sivasankaralingam, V Raman, A Maghbouli, J Li. *Impact of emulsion fuel with nano-organic additives on the performance of diesel engine.* Applied Energy, 112:1206–1212, 2013. *DOI: 10.1016/j.apenergy.2013.02.027.* [SCI]

48. <u>WM Yang</u>, H An, SK Chou, S Vedharaj, R Vallinayagam, **M Balaji**, FEA Mohammad, KJE Chua. *Emulsion fuel with novel nano-organic additives for diesel engine application.* Fuel, 104:726–731, 2013. *DOI: 10.1016/j.fuel.2012.04.051.* [SCI]

Refereed conference papers and other articles

<u>Underline</u> - Presenter/ Corresponding Author

1. S Kommalapati, <u>P Pal</u>, N Kuzhagaliyeva, A AlRamadan, **B Mohan**, Y Pei, M Sarathy, E Cenker, J Badra. *Uncertainty Quantification of a Deep Learning Based Fuel Property Prediction Model.* Bulletin of the American Physical Society, Indiana, USA. *G14.00005. (Oral presentation)*

2. <u>X Liu</u>, A Zaihi, M Allehaibi, **B Mohan**, A AlRamadan, E Cenker, HG Im. *Investigation of the Cryogenic Nitrogen and Non-Cryogenic N-Dodecane and Ammonia Injections using a Real-Fluid Modelling Approach.* SAE Powertrains, Fuels & Lubricants Conference & Exhibition, Naples, Italy. *2022-01-1078. (Oral presentation)*

3. <u>F Almatrafi</u>, M Silva, MB Houidi, E Cenker, J Badra, **B Mohan**, HG Im, J Turner. *Numerical Investigation of the Effects of Piston Design and Injection Strategy on Passive Pre-chamber Enrichment.* SAE Powertrains, Fuels & Lubricants Conference & Exhibition, Naples, Italy. *2022-01-1041. (Oral presentation)*

4. **B Mohan** , J Badra. *Prediction of ECN Spray—A Characteristics Using Machine Learning.* SAE 2022 World Congress and Exhibition, Detroit, USA. *2022-01-0494. (Oral presentation)*

5. <u>AS Ramadan</u> , ZA Ibrahim, **B Mohan**, J Badra. *Machine Learning Model for Spark-Assisted Gasoline Compression Ignition Engine.* SAE 2022 World Congress and Exhibition, Detroit, USA. *2022-01-0459. (Oral presentation)*

6. <u>ZA Ibrahim</u>, AS Ramadan, **B Mohan**, J Badra. *Machine learning model for gasoline compression ignition at low loads.* Asia-Pacific Conference on Combustion (ASPACC) 2021, Abu Dhabi, UAE. (*Oral presentation*)

7. **B Mohan**, J Badra. *Data-driven prediction of flame lift-off-length and ignition delay of ECN spray-A.* Asia-Pacific Conference on Combustion (ASPACC) 2021, Abu Dhabi, UAE. (*Oral presentation*)

8. <u>M Allehaibi</u>, X Liu, H Aljabri, MB Houidi, H Im, **B Mohan**. *Investigation of the Engine Combustion Network Spray C Characteristics using Eulerian Models.* SAE Naples 2021, Napoli, Italy. *2021-24-0056. (Oral presentation)*

9. **B Mohan**, M Tang, J Badra, Y Pei, M Traver. *Machine Learning and Response Surface-Based Numerical Optimization of the Combustion System for a Heavy-duty Gasoline Compression Ignition Engine.* SAE 2021 World Congress and Exhibition, Detroit, USA. *2021-01-0190. (Oral presentation)*

10. <u>S Sanal</u>, **B Mohan**, FEH Perez, HG Im. *Numerical study on spray characteristics of methanol under vaporizing and non-reacting condition.* Asia-Pacific Conference on Combustion (ASPACC) 2019 , Fukuoka, Japan. (Oral presentation)

11. <u>Y Li</u>, A Alfazazi, **B Mohan**, M Sarathy, J Badra. *Development of a 4-Component (iso-Octane/n-Heptane/Toluene/Ethanol) Reduced Gasoline Surrogate Model under Engine Conditions.* SAE 2019 World Congress and Exhibition, Detroit, USA. (Only oral presentation)

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Kyoto, Japan. *2019-01-2249.* (Oral presentation)

13. J Du, **B Mohan**, J Sim, T Fang, WL Roberts. *Spray ignition charcacteristics of low octane gasoline using a gasoline multi-hole injector.* 11th Mediterranean Combustion Symposium MCS Tenerife, Spain) Portugal. (Oral presentation)

14. Q Zhou, M Jaasim, **B Mohan**, XC Lu, HG Im. *A Computational Study of Lean Limit Extension of Alcohol HCCI Engines.* SAE International Powertrains, Fuels & Lubricants Meeting, SAE 2018, Heidelberg, Germany. *2018-01-1679.* *(Oral presentation)*

15. M Jaasim, N Atef, **B Mohan**, A Sow, FEH Pérez, J Badra, J Sim, SM Sarathy, HG Im. *A comprehensive engine study: from surrogate chemistry formulation to engine simulations.* THIESEL 2018 Conference on Thermo and Fluid Dynamic Processes in Direct Injection Engines, valencia, Spain. *(Oral presentation)*

16. J Du, **B Mohan**, J Sim, WL Roberts. *Experimental study on the non-reacting spray characterization of gasoline compression ignition fuel.* 10th International Conference on Applied Energy - ICAE 2018, Hong Kong. *DOI: 10.1016/j.egypro.2019.01.453.* *(Oral presentation)*

17. **B Mohan**, M Jaasim, FH Perez, J Sim, WL Roberts, HG Im. *Internal and near nozzle flow simulations of gasoline multi-hole injectors with transient needle motion.* CAV2018, Baltimore, USA. *DOI: 10.1115/1.861851_ch112* *(Oral presentation)*

18. **B Mohan**, M Jaasim, FEH Perez, J Sim, WL Roberts, M Sarathy, HG Im. *Numerical simulations of high reactivity gasoline fuel sprays under vaporizing and reactive conditions.* SAE 2018 World Congress and Exhibition, Detroit, USA. *2018-01-0292.* *(Oral presentation)*

19. X Cui, **B Mohan**, MR Islam, SK Chou, KJ Chua. *Investigation on a combined air treatment process for air-conditioning system.* 9th International Conference on Applied Energy, ICAE 2017, Cardiff, UK. *DOI: 10.1016/j.egypro.2017.12.578.* *(Oral presentation)*

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21. **B Mohan**, X Cui, KJ Chua. *Development of chemical reaction kinetics for VOC Ozonation.* International High- Performance Built Environment Conference – A Sustainable Built Environment Conference 2016 Series (SBE16), iHBE 2016, Sydney, Australia. *DOI: 10.1016/j.proeng.2017.04.300.* *(Oral presentation)*

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23. KL Tay, W Yang, SK Chou, D Zhou, J Li, W Yu, F Zhao, **B Mohan**. *Effects of Injection Timing and Pilot Fuel on the Combustion of a Kerosene-diesel/Ammonia Dual Fuel Engine: A Numerical Study.* 8th International Conference on Applied Energy – ICAE 2016, Beijing, China. *DOI: 10.1016/j.egypro.2017.03.1002.* *(Oral presentation)*

24. W Yu, W Yang, **B Mohan**, KL Tay, F Zhao, Y Zhang, S Chou, M Kraft, MA Alexander, A Yong, K Lou. *Numerical and Experimental Study on Internal Nozzle Flow and Macroscopic Spray Characteristics of a Kind of Wide Distillation Fuel (WDF) - Kerosene.* SAE Technical Paper, SAE 2016 World Congress and Exhibition, Detroit, USA. *2016-04-05. (Written Technical paper)*

25. **B Mohan**, WM Yang, KL Tay, W Yu, SK Chou. *Numerical simulation on spray characteristics of ether fuels.* 7th International Conference on Applied Energy, ICAE 2015, Abu Dhabi, UAE. *DOI: 10.1016/j.egypro.2015.07.243. (Oral presentation)*

26. <u>W Yu</u>, WM Yang, **B Mohan**, KL Tay, F Zhao, SK Chou. *Multiple Injections study based on an advanced combustion investigation system.* 7th International Conference on Applied Energy, ICAE 2015, Abu Dhabi, UAE. *DOI: 10.1016/j.egypro.2015.07.222. (Oral presentation)*

27. **B Mohan**, WM Yang, SK Chou. *Effects of injection rate shaping on combustion and emission characteristics of biodiesel fueled CI engine - A CFD study.* 6th International Conference on Applied Energy, ICAE 2014, Taipei, Taiwan. *(Oral presentation)*

28. **B Mohan**, WM Yang, V Raman, V Sivasankaralingam, SK Chou. *Optimization of biodiesel fuelled engine to meet emission standards through varying nozzle opening pressure and static injection timing.* 5th International Conference on Applied Energy, ICAE 2013, Pretoria, South Africa. *(Oral presentation)*

29. <u>WM Yang</u>, H An, SK Chou, KJ Chua, **M Balaji**, S Vedharaj, R Vallinayagam, FEA Mohammad. *Impact of emulsion fuel with nano-organic additives on the performance of diesel engine.* 4th International Conference on Applied Energy, ICAE 2012, Suzhou, China. *(Oral presentation)*

30. <u>S Bharath</u>, **M Balaji**, GR Sai Krishna. *Future of NEMS.* 1st International Conference on Micro/Nanoscale Heat Transfer, Parts A and B, ASME 2008, Tainan, Taiwan. *DOI: 10.1115/MNHT2008-52239. (Oral presentation)*

Manuscripts in Communication or under Preparation

B Mohan, J Chang. *ChemSL: Chemical SuperLearner, an automated and explainable machine learning framework to build models to predict physical and chemical properties. under preparation for Chemical Engineering Journal.*

Awards and Achievements

○ **Best Presenter**, SAS-CI   Oct 2022
Awarded the best presenter at 12th Saudi Arabian Section of Combustion Institute (SAS-CI) in *Application of ML/AI* tools session

○ **Outstanding Reviewer**, Chemical Engineering and Processing: Process Intensification   Oct 2018
Awarded for being within the top 10th percentile of reviewers for the Journal, in terms of the number of manuscript reviews completed in the last two years

○ **Outstanding Reviewer**, Applied Energy   May 2015
Awarded for being within the top 10th percentile of reviewers for the Journal, in terms of the number of manuscript reviews completed in the last two years

○ **NUS Research Scholarship**, NUS   2011 – 2015
Awarded NUS Graduate Research Scholarship

○ **State Eleventh Rank**, Anna University   June 2008
Awarded Eleventh rank among 5308 Mechanical engineers graduated in 2008 from Anna University, India

○ **Merit Scholarship**, Velammal Engineering College   2004 – 2008
Awarded for being Top ranked student in Mechanical Engineering during 2nd, 6th and 7th semesters

Professional Memberships and Services

○ Member of The Combustion Institute (Saudi Arabian Section) (The Combustion Institute)
○ Member of Society of Automotive Engineers (SAE)

○ Reviewer for international journals
  - Journal of Engineering for Gas Turbines and Power
  - Plos One
  - Advances in Polymer Technology
  - Applied Energy
  - Applied Mathematical Modelling
  - Applied Thermal Engineering
  - Chemical Engineering & Processing: Process Intensification
  - Data in Brief
  - Energy
  - Energy Conversion and Management
  - Energy Efficiency
  - Energy & Fuels
  - Experimental Thermal and Fluid Science
  - Fuel
  - International Conference on Applied Energy (ICAE)
  - International Journal of Engine Research
  - Process Safety and Environmental Protection
  - Renewable Energy
  - SAE Technical conferences

○ Session co-chair on *Spray, Droplet, and Supercritical Combustion*, 13th Asia-Pacific Conference on Combustion, December 2021, ADNEC, Abu Dhabi, United Arab Emirates.

Certificates

○ **Applied Data Science Specialization** by IBM (Coursera), Credential ID: 7L3LJ3SK5G6V, 2020.

○ **Data Analysis with Python** by IBM (Coursera), Credential ID: 638ZPJ47ST6T, 2020.

○ **Applied Data Science Capstone** by IBM (Coursera), Credential ID: 9Q2HQW9Y3M5L, 2020.

○ **Python for Data Science and AI** by IBM (Coursera), Credential ID: 4LALXRKHKJEF, 2020.

○ **Machine Learning with Python** by IBM (Coursera), Credential ID: MTEYDZQLVDMB, 2020.

○ **Data Visualization with Python** by IBM (Coursera), Credential ID: 5ZNEJ7N5ECSR, 2020.

○ **Introduction to Deep Learning & Neural Networks with Keras** by IBM (Coursera), Credential ID: JTC9U3N4CTWK, 2020.

○ **Introduction to Applied Machine Learning** by amii (Coursera), Credential ID: 7X4EUXUMT223, 2020.

○ **Introduction to Artificial Intelligence (AI)** by IBM (Coursera), Credential ID: 6JHFYMB6X3TC, 2020.

○ **Introduction to ANSYS CFD** by ANSYS and Fluid Codes, 2019.

○ **Combustion Institute Summer School (CISS)** organized by *King Abdullah University of Science and*

Technology (KAUST), Saudi Arabia, 2018.

○ **Principles, Operation and Maintenance of Automated GC-MS** by *Shimadzu Asia-Pacific Pte. Ltd., Singapore*, 2016.

Skills

CFD Packages..
  Converge, KIVA–4, Ansys Fluent, CHEMKIN, OpenFOAM

Meshing Software...
  ICEM CFD, Gambit, KIVA–4 pre-processor (k3prep), Gmsh

Post-Processing Software..
  ParaView, VisIt, EnSight, General Mesh Viewer (GMV), Tecplot

Computer programming..
  Python, R, Fortran, C, C++

Numerical computational Packages...
  Numpy, Scipy, Pandas, Scikit-Learn MATLAB, Scilab

CAD and Modelling Software..
  AutoCAD, Solidworks, Pro/ENGINEER

Desktop Publishing Software..
  TEX (LATEX, BIBTEX, LYX, Beamer), Microsoft office, Libreoffice

Productivity Software..
  Adobe Photoshop, GIMP, Visio, Matplotlib, OriginPro, Gnuplot, EndNote, Mendeley, Jabref

Operating Systems..
  Microsoft Windows, Linux (Debian based), Mac OS

Experimental Skills...

  Multi–cylinder and single–cylinder powertrain calibration and development activities.
  Use of ultra–high speed camera (Photron SA5, SA4)
  GC—MS (Gas Chromatography—Mass Spectrometer) to analyze composition of different bio–fuels.
  AVL engine control systems (AVL Indicom, AVL Concerto) .

References

○ Available upon request