Mahdi Darzi, PhD

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Education and Training

PhD: Mechanical Engineering, West Virginia University, Morgantown, US   **2015-2019**
MSc: Mechanical Engineering, University of Tehran, Tehran, Iran   **2010-2013**
BSc: Mechanical Engineering, Tehran Polytechnic, Tehran, Iran   **2006-2010**

Research and Professional Experience

Volvo Group Truck Technology-GTT   **Lead Systems Simulation Engineer, Aug 2019- Present**

- Engine simulation and optimization.
- Software-in-the-loop simulation.
- Hardware-in-the-loop simulations.
- Virtual engine calibration.
- Software verification.
- Simulation work package leader in DOE's super truck 2 project.

Volvo Group Truck Technology-GTT   **CO-OP, Jan-Jun 2019**

- CFD boundary conditions for piston heat load.
- Super truck 2 engine design optimization.
- CARB future compliance data analysis for real-world emissions.

MAE and CAFEE   **Graduate Research Assistant, Aug 2015-Aug 2019**

ARPA-E GENSETS

- Engine lab development.
- Engine control and calibration for peak power fuel economy.
- Design and conduct engine experiments with
- CFD simulation of a low-pressure direct injection natural gas engine.
- Genetic algorithm optimization of the exhaust resonator design.

Emissions

- Engine lab QA/QC, chassis emissions test and PEMS QA/QC.
- After-treatment system configuration study on heavy-duty diesel engines.
- OBD tuning for urea injector flow signal using catalyst temperature and engine air flow feedbacks.

Methane Quantification

- Direct and indirect methane quantification using full flow sample and open path analyzer measurements.
- Instruments calibrations and extracting real-world correction factors.

Vehicle, Fuel, and Environmental Research Institute   **R&D Engineer 2013-2015**

- Determining gaseous fuel quality correction factor for light duty bi-fuel vehicles' BSFC.
- Quasi-dimensional engine simulation using detailed chemistry to predict knock and emissions in a high compression ratio NG engine.
- NG fuel composition effect on performance and emissions on a variable CR single cylinder engine.

Vehicle, Fuel, and Environmental Research Institute   **GRA 2010 – 2013**

- Experimental knock onset detection using in-cylinder pressure data, on different operation modes and fuels.
- One-D combustion modeling of IC Engines.
- Energy and exergy audit on natural gas engines.

Vehicle, Fuel, and Environmental Research Institute   **CO-OP, 2010**

- VVT Simulation on a Heavy-Duty Diesel Engine Applying the Miller Cycle Using GT-Power.

Expertise
- In-cylinder pressure data acquisition and analysis
- Engine calibration and control
- Emissions data analyses
- Sustainable energy

- 3D CFD
- 1D system simulation
- Machine design
- Greenhouse gas emissions

Peer-Reviewed Publications

1. Nima Zamani Meymian, **Mahdi Darzi**, Derek Johnson, Parviz Famouri, "Pre-design Investigation of Resonant Frequency Effects on Gas Exchange Efficiencies of a One-kW Natural-Gas Linear Engine Alternator", SAE Technical Paper 2020-01-0488, 2020, DOI: https://doi.org/10.4271/2020-01-0488.
2. **Mahdi Darzi**, Derek Johnson, Chris Ulishney, Dakota Oliver, "Gaseous fuels variation effects on first and second law analyses of a small direct injection engine for micro-CHP systems", *Energy Conversion and Management*, Volume 184, 15 March 2019, Pages 609-625. DOI: 10.1016/j.enconman.2019.01.045.
3. Nima Zamani Meymian, Nigel N. Clark, Terence Musho, **Mahdi Darzi**, Derek Johnson, Parviz Famouri, "An Optimization Method for Flexural Bearing Design for High-stroke High- Frequency Applications," *Cryogenics,* Accepted Sep 2018. DOI: 10.1016/j.cryogenics.2018.09.008.
4. **Darzi, M.**, Johnson, D., Bade, M., and Famouri, P., "Gaseous Fuels Variation Effects on Combustion and Emissions of a Small Direct Injection Natural Gas Engine," SAE Technical Paper 2019-01-0560, 2019, DOI: 10.4271/2019-01-0560.
5. Bade, M., Clark, N., Famouri, P., Guggilapu, P., **Darzi, M.**, Johnson, D., "Sensitivity Analysis and Control Methodology for Linear Engine Alternator," SAE Technical Paper 2019-01-0230, 2019, DOI: 10.4271/2019-01-0230.
6. Zamani Meymian, N., Clark, N., Subramanian, J., Heiskell, G., Johnson, D., Mahmudzadeh, F., **Darzi, M.**, Musho, T., Famouri, P., "Quantification of Windage and Vibrational Losses in Flexure Springs of a One kW Two-Stroke Free Piston Linear Engine Alternator," SAE Technical Paper 2019-01-0816, 2019, DOI: 10.4271/2019-01-0816.
7. **Mahdi Darzi**, Derek Johnson, Chris Ulishney, Nigel Clark, "Low Pressure Direct Injection Strategies Effect on a Small SI Natural Gas Two-Stroke Engine's Energy Distribution, Performance, and Emissions", *Applied Energy*, Volume 230, 15 November 2018, Pages 1585-1602. DOI: 10.1016/j.apenergy.2018.09.091.
8. Johnson, D., **Darzi, M.**, Clark, N., Nix, A. et al., "In-Use Efficiency of Oxidation and Three-Way Catalysts Used in High-Horsepower Dual Fuel and Dedicated Natural Gas Engines," *SAE Int. J. Engines* 11(3):2018, DOI:10.4271/03-11-03-0026.
9. Derek Johnson, Robert Heltzel, Andrew Nix, **Mahdi Darzi**, and Dakota Oliver," Estimated Emissions from the Prime-Movers of Unconventional Natural Gas Well Development Using Recently Collected In-Use Data in the United States", *Environmental Science & Technology*, 13 April 2018, DOI: 10.1021/acs.est.7b06694.
10. Derek R. Johnson, Robert Heltzel, Andrew C. Nix, Nigel Clark, **Mahdi Darzi**, "Greenhouse gas emissions and fuel efficiency of in-use high horsepower diesel, dual fuel, and natural gas engines for unconventional well development", *Applied Energy*, Volume 206, 15 November 2017, Pages 739-750, ISSN 0306-2619.
11. Johnson DR, Heltzel R, Nix AC, Clark N, **Darzi M** (2017), "Regulated Gaseous Emissions from In-use High Horsepower Drilling and Hydraulic Fracturing Engines". *J Pollut Eff Cont* 5: 187. DOI: 10.4176/2375-4397.1000187.

12. Javaheri, V. Esfahanian, A. Salavati-Zadeh, **M. Darzi**, "Energetic and exergetic analysis of variable compression spark ignition gas engine", Elsevier, *Energy Conversion and Management*, volume 88, Dec 2014, pp. 739-748.
13. Javaheri, V. Esfahanian, A. Salavati-Zadeh, **M. Darzi**, S. M. Mirsoheil, "Investigation of Natural Gas Composition Effects on Knock Phenomenon in SI Gas Engines using Detailed Chemistry", *Applied Mechanics and Materials* volume 493, Jan 2014, pp. 239 – 244.
14. **Darzi M**, Johnson D, Ulishney C, Bade M, Zamani N. Baseline Evaluation of Ignition Timing and Compression Ratio Configurations on Efficiency and Combustion Stability of a Small-Bore, Two-Stroke, Natural Gas Engine. ASME. *ASME International Mechanical Engineering Congress and Exposition, Volume 6: Energy* (): V006T08A002. DOI:10.1115/IMECE2017-70078.
15. Johnson D, **Darzi M**, Ulishney C, Bade M, Zamani N. Methods to Improve Combustion Stability, Efficiency, and Power Density of a Small, Port-Injected, Spark-Ignited, Two-Stroke Natural Gas Engine. ASME. *Internal Combustion Engine Division Fall Technical Conference*, Volume 2: Emissions Control Systems; Instrumentation, Controls, and Hybrids; Numerical Simulation; Engine Design and Mechanical Development (): V002T07A008. DOI:10.1115/ICEF2017-3557.
16. **Darzi, M.,** Johnson, D., Ulishney, C., Bade, R. et al., "Quantification of Energy Pathways and Gas Exchange of a Small Port Injection SI Two-Stroke Natural Gas Engine Operating on Different Exhaust Configurations," *SAE Technical Paper* 2018-01-1278, 2018.
17. **Darzi, M.,** Johnson, D., Bade, R., Ulishney, C. et al., "Continuously Varying Exhaust Outlet Diameter to Improve Efficiency and Emissions of a Small SI Natural Gas Two-Stroke Engine by Internal EGR" *SAE Technical Paper* 2018-01-0985, 2018.
18. Salavati-Zadeh A, **Darzi M**, Javaheri Ahmad, Esfahanian Vahid, Mirsoheil Seyed Mojtaba, "Experimental and Detailed Kinetic Investigation on the Effect of Natural Gas Composition on Emissions of the Gas Fueled SI Engine", in: *Proceedings of FISITA World Automotive Congress,* June 2014, FISITA 2014/F2014-CET-157.

Abstracts

- Direct Quantification of Methane Emissions Across the supply Chain: Identification of Mitigations Targets (Dec 2017 – New Orleans, 2017 AGU Fall Meeting).

Paper Reviews

- SAE
- ASME
- Journal of Energy Conversion and Management