Dr. Gregory J. Hampson

Education

The Colorado College, Colorado Springs, CO
B.A. Economics, minor in Physics, Music and Div I Ice Hockey, 1984
Undergraduate Thesis Topic: *Effect of Energy Market Failure on Solar Energy*

University of Colorado – Boulder, CO
Undergraduate Mechanical Engineering, 1985-1987

Stanford University, Palo Alto, CA
M.S. Mechanical Engineering, Thermosciences Division, 1985-1987
Advisor: Thomas Connelly

University of Wisconsin – Madison, Engine Research Center, Madison, WI
Ph.D. Mechanical Engineering, 1997
Minor Applied Mathematics
Advisors: Rolf Reitz, David Foster
Thesis Topic: *3D CFD Modeling of Soot and NOx Emissions with Experiments*

Present Position:

Woodward, Inc, Loveland, CO
Director of Engineering, Technology Group, 2016-present
Senior Principal Engineer, 2010 - 2016
Lead R&D Programs for Woodward's IC Engines Division

Previous Positions:

Rensselaer Polytechnic Institute, Troy, NY, Clinical Assistant Professor of ME 2009 – 2010

Engineering Systems Analysis, LLC. Schenectady, NY, Co-Founder and Principal Engineer, 2003 – 2009

Quality Engineering & Software Technologies, Schenectady, NY, Director, IC Engine Division, 2001-2003

GE Corporate Research and Development, Niskayuna, NY– Senior Research Engineer, Diesel Combustion Programs, 1997-2003

GE Nuclear, San Jose, CA, Edison Engineering Program, Nuclear Hydraulics Code Engineer, 1990-1992

GE Aircraft Engines, Cincinnati, OH, Edison Engineering Program, Combustor Development Engineer, 1989-1990

Chevron Research, Richmond, CA, Fuel Research Engineer, 1988-1989

Solar Energy Research Institute, Wind Turbine Branch, Boulder, CO, 1987

Research Areas and Interests:

Dr. Hampson's interest include combustion in gas turbine and internal combustion engines, especially ignition phenomena and engine knock and end-gas auto-ignition. Using CFD, fast prototyping, and on-engine experiments, develop strategies and technology to push reciprocating engines to higher efficiency and lower emissions. Recent developments in natural gas fueled engines include using EGR to increase power density and suppress knock while improving efficiency, Prechamber combustion for improved stability and fast combustion, Prechamber spark plug product development, Laser Ignition development, Dual Fuel and RCCI combustion, Combustion feedback for controlled end gas auto-ignition. Dr. Hampson also leads the use of computer modeling and simulation as well as Design for Six Sigma methodologies to improve the

product development cycle and effectiveness. He is also particularly interested in alternative fuels including natural gas, biogas, and renewable hydrogen.

Selected Collaborators:

Anthony Marchese, Colorado State University – RCCI modeling and DOE funded research on methods to use controlled end gas auto-ignition to push On-Highway gas engines to match 45% BTE of diesels.

Gregory Bogin, Colorado School of Mines, sponsored 2 Senior Design projects and IC Engine Controls Development Laboratory.

Dave Montgomery, Caterpillar, Co-Advisor for Dedicated EGR Senior Design Project, Colorado State University

Mark Musculus, Sandia National Labs, Livermore, CA, Knock Processes in Gas Engines

Students Supervised (over the last 5 years):

Andrew Hockett (Co-Advisor with Anthony Marchese Ph.D., Colorado State University, 2016)
Andrew Zdanowicz (Co-Advisor with Anthony Marchese Ph.D., Colorado State University, 2019)

Teaching Experience

University of Colorado, Boulder

Internal Combustion Engines (Spring 2020)

Woodward, Loveland, CO

Introduction to Gas Engines 101

Design Requirements Propagation

Colorado State University, Ft. Collins, CO

Affiliate Professor of Mechanical Engineering, PhD advisor

Rensselaer Polytechnic Institute (RPI), Troy, NY

Undergraduate: Thermo-Fluid Dynamics Spring, Summer
Machine Dynamics
Sophomore Engineering Design
Senior Capstone Engineering Design
Engine Combustion section of Introduction to Combustion

Graduate: Conduction Heat Transfer

Garden City Waldorf High School, Garden City, NY

10th Grade Physics - Mechanics

GE Edison Engineering Program

Linear Algebra

Invited Lectures

"Gas Engines", ASME, University of Colorado Boulder

"Engine Efficiency, "ASME, University of Colorado Boulder

"A "Wire-Frame" Engine Cycle Design Tool for Designing Advanced Combustion to Achieve High Efficiency and High Load Engine Cycles", Mechanical Engineering Departmental Seminar, Colorado State University, September, 2012.

SAE – Co-Chair, SI Modeling – Alternative Fuels, Chair: Professor Angelo Onorati, Politecnico DI Milano, Detroit MI, April, 2009.

SAE – Engine Simulations, SAE TOPTEC, co-chaired with Dr. SM Shahed, New Delhi, India, January, 2008

Mahindra Tractor, GT-POWER Engine Simulation Methods and Best Practices, 8 day training session, Mumbai, India, May, 2007 and Jan 2008.

Patents:

1. US Patent 9,765,682, Multi-Chamber Igniter, Domenico Chiera, Gregory J. Hampson, Sept, 2017
2. US Patent 9,133,795, Engine using split flow exhaust system and methods, Michael B. Riley, Gregory James Hampson, 2015-09-15
3. US Patent 9,172,217, Pre-chamber spark plug with tubular electrode and method of manufacturing same, Domenico Chiera, Gregory J. Hampson, 2015-10-27
4. US Patent 8,925,518, USE OF PRECHAMBERS WITH DUAL FUELSOURCE ENGINES, Michael B. Riley, Gregory J. Hampson, Domenico Chiera, Jan. 6, 2015
5. US Patent 9,476,347, Controlled spark ignited flame kernel flow in fuel-fed prechambers, Domenico Chiera, David C. Petruska, Gregory J. Hampson, Oct. 25, 2016
6. US Patent 9,890,690, Passive prechamber direct injection combustion, Domenico Chiera, Gregory J. Hampson, Feb. 13 , 2018
7. US Patent 9,840,963, Parallel prechamber ignition system, Domenico Chiera, Gregory J. Hampson, Dec. 12 , 2017
8. US Patent 8,839,762, Multi-chamber igniter, Domenico Chiera, Gregory J. Hampson, Nolan Polley, Sep. 23, 2014
9. US Patent 8,584,648, CONTROLLED SPARK IGNITED FLAME KERNEL FLOW, Domenico Chiera, Gregory J. Hampson, Nov. 19, 2013
10. US Patent 10,054,102, Quiescent chamber hot gas igniter, Domenico Chiera, Gregory J. Hampson, Aug. 21 , 2018
11. US Patent 9653886, Cap shielded ignition system, Domenico Chiera, Gregory J. Hampson, May 16, 2017
12. US Patent 10012155, Combustion pressure feedback based engine control with variable resolution sampling windows, Jason Barta, Gregory James Hampson, Jeffrey Carlson, Jul. 3 , 2018
13. US Patent 20060137335, Pedal position and/or pedal change rate for use in control of an engine, GE Stewart, SM Shahed, F Borrelli, GJ Hampson
14. Patent Pending: CONTROL SYSTEM FOR A DIESEL ENGINE, , S KOLAVENNU, F BORRELLI, G HAMPSON, S SHAHED, 2007 Eurasian Patent Organization (EAPO)
15. US Patent 7,328,577: Multivariable control for an engine, SN Kolavennu, F Borrelli, GJ Hampson, SM Shahed, 2008
16. Patent Pending: EGR system SM Shahed, GJ Hampson - US Patent App. 11/005,983, 2004 US 20060117750A1 United States, Patent Application Publication
17. US Patent 7,155,334, Use of sensors in a state observer for a diesel engine, SN Kolavennu, F Borrelli, GJ Hampson, SM Shahed, 2006
18. Patent Pending, Model Based Control of Diesel Engines –2005
19. Patent Pending: Method for Optimal Gas Flow Distribution Manifold, in submission by GE Power Systems, May, 2002.

20. US Patent 7,117,675: Cooling of liquid fuel components to eliminate coking, submission by GE Power Systems, May, 2002.

21. US Patent 6,557,503 - Method for lowering fuel consumption and nitrogen oxide emissions in two-stroke diesel engine, May, 6, 2003.

22. US Patent 7,783,507 System and method for managing a fleet of remote assets, LA Schick, KM Mangino, GJ Hampson, PE Cuddihy, US Patent App. 09/736,495, 2000 US 20020065698A1 United States Patent Application Publication

23. US Patent 6,473,720 - Method for monitoring product performance [six sigma processes], October 29, 2002.

24. US Patent 6,415,606 - Method and apparatus for turbocharging an engine of a locomotive, July 9, 2002.

25. Patent Application: Auxiliary energy management system for mobile diesel electric power plants, GJ Hampson, RD King, JE Kindling - US Patent App. 09/681,225, 2001

26. US Patent 6,152,122 - Combustion enhancing insert for cylinder of internal combustion engine, November 28, 2000.

Publications:

Hampson, G.J., Chiera, D., Carlson, J, McCreery, S, Nair, S , ASME HIGH EFFICIENCY NATURAL GAS ENGINE COMBUSTION USING CONTROLLED AUTO-IGNITION, ICEF2019-7292, ASME 2019 Internal Combustion Fall Technical Conference, October 20-23, 2019, Chicago, Illinois, USA

Nair, S., Carlson, J., Barta, J., Hampson, G.J., Performance Comparison of Vibration Knock Sensors and In-Cylinder Pressure for Protection of Gas and Dual Fuel Engines, 10th Dessau Gas Engine Conference, April, 2017

William, R., Chiera, D., Knutzen, H., Hampson, G.J.. EGR AND BACKPRESSURE EFFECTS ON KNOCK BEHAVIOR IN STOICHIOMETRIC NATURAL GAS ENGINES, ICEF2017-3669, ASME 2017 Internal Combustion Fall Technical Conference, October 15, 2017

Hockett, A. G., Barta, J., Hampson, G., Baumgardner, M., Marchese, A. J. (2015). An Experimental and Multidimensional Computational Study on Uncontrolled Combustion Rates in a Light Duty Natural Gas/Diesel Dual Fuel Engine. Combustion Science and Technology. Submitted.

Hockett, A. G., Hampson, G.J. and Marchese, A. J. (2015). Sensitivity Study on Natural Gas/Diesel RCCI CFD Simulations Using Multi-component Fuel Surrogates. International Journal of Powertrains, Submitted.

Hockett, A. G., Hampson, G.J. and Marchese, A. J. (2015). Reduced Chemical Kinetic Mechanism for CFD Simulations of Natural Gas/Diesel Dual Fuel Engines: Mechanism Development and Comparisons with Engine Experiments. Energy and Fuels, Submitted.

J. Barta, A. Hockett, B. Suhre, and G.J.Hampson "PRACTICAL CYLINDER PRESSURE MONITORING FOR PRODUCTION IC ENGINES COMBUSTION CONTROL USING REAL-TIME COMBUSTION DIAGNOSTICS AND CONTROL (RT-CDC) MODULE, 9th Dessau Gas Engine Conference, pp 111 – 120, April, 2015

D. Chiera, R. Boom, G.J. Hampson, "Second Generation Prechamber Spark Plug for Retrofit and Lean Limit Extension in Gas Engines,", 8th Dessau Gas Engine Conference, pp 111 – 120, March, 2013

Chiera, D; Riley, M, and G. J. Hampson, "MECHANISM FOR HIGH VELOCITY TURBULENT JET COMBUSTION FROM PASSIVE PRECHAMBER SPARK PLUG", 2012 ASME Fall Technical Conference, ICEF 2012-92030, September, 2012

Chiera, D; Ahrens, D; Polley, N; Petruska, D; Riley, M. and G. J. Hampson, "Lean Limit Extension for High BMEP Gas Engines via Novel Electronic Ignition and Prechamber Plug – High Efficiency and Lower NOx in Open Chamber Engines", 2011 ASME Fall Technical Conference, ICEF2011-60115, Oct, 2011.

Patterson, M.A. and G.J. Hampson, "Heat Release Design Method for HCCI in Diesel Engines with Simulation", SAE Technical Paper, 2008-28-0006, 2008.

Hampson, G.J., "Heat Release Design Method for HCCI in Diesel Engines", SAE Technical Paper, 2005-01-3728, 2005.

Dave, A, A. Siddiqui, D. Probst, and G.J. Hampson, "Development of a Reed Valve Model for Engine Simulations for Two-Stroke Engines," SAE 2004-01-1455, SAE Congress Detroit, March 2004.

Dave, A. and G.J. Hampson, "Robust Engine Design Using Engine Simulations," SAE Technical Paper 2003-01-0371 and Special Publication -SP-1745, 2003.

Probst, D. and G.J. Hampson, "Fundamental Analysis and Simplified Model of MEMS Mesopump," Client Report, QuEST, July 2003.

G.J. Hampson, "Diesel Engine Fundamentals, including Turbocharging, Controls and Emissions," Client Report, Honeywell Automation and Controls Systems, Minneapolis, MN, May, 2003.

Probst, D. and G.J. Hampson, "Model of MEMS Meso Liquid Piston Engine", Client Report, QuEST, Jan 2003.

G.J. Hampson, "Fundamentals and Root Cause Analysis of Condensation and Freezing in Gas Turbine Auxiliary Air System," Client Report, GE Power Systems, January, 2002.

Hampson, G.J. and R.D. Reitz, "Two-Color Method for Diesel Engine Soot and Temperature Measurements," SAE Technical Paper, 980524, 1997.

Hampson, G.J., "A Theoretical and Experimental Study of Multidimensional Modeling of Soot and NOx Emissions for Diesel Engines," Ph.D. Thesis, Department of Mechanical Engineering, University of Wisconsin – Madison, Madison, Wisconsin, April, 1997.

SAE Horning Memorial Award for most significant paper contributing to the field of Engines and Fuels, 1996.
Han, Z., A. Uludogan, G.J. Hampson and R.D. Reitz, "Mechanism of Soot and NOx Emissions Reduction Using Multiple-Injection in a Diesel Engine," SAE Technical Paper and SAE Transactions, 960633.

Hampson, G.J. "Experimental Method for Combustor Evaluation," Internal Report, GE Aircraft Engines, Evendale, OH, Dec, 1989.

Hampson, G.J. "Experimental Method for Fuel Injector Plugging Evaluation," Internal Report, Fuels Division, Chevron Research Corp, San Ramon, CA, May, 1989.

Hock, S., G.J. Hampson and R. Thresher, "Howden Wind Turbine Performance Report," ASME Technical Paper, 1987.

Hampson, G.J., "Effect of Energy Market Failure on Solar Energy," Economics Thesis, Colorado College, Colorado Springs, CO, June 1983.

Memberships:

CIMAC – Gas Engine Working Group
SAE, ASME (historical member)