

# **Rolf D. Reitz**



## **Wisconsin Distinguished Professor**

Engine Research Center  
Mechanical Engineering Department  
Room 1018A Engineering Research Building  
1500 Engineering Drive  
University of Wisconsin, Madison 53706

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# ROLF DENEYS REITZ

## ***Personal:***

Birth: Nov. 1, 1948

Place: Pietermaritzburg, South Africa

Naturalized US Citizen October 4, 1979

Married: 2 Children

## ***Formal Education:***

Ph.D. in Mechanical and Aerospace Engineering, Princeton University, 5/78

M.A. in Mechanical and Aerospace Engineering, Princeton University, 6/75

M.S. in Mechanics, State University of New York, Stony Brook, 12/73

M.Sc. (Eng) in Mechanical Engineering, University of Cape Town, RSA, 6/72

B.Sc. (Eng) in Mechanical Engineering, University of Cape Town, RSA, 12/70

## ***Positions Held:***

8/15 - Present	Emeritus Professor	Mechanical Engineering, University of Wisconsin-Madison
1/99 - 8/15	Wisconsin Distinguished Professor	Mechanical Engineering, University of Wisconsin-Madison
1/12 - 8/15	Director, Engine Research Center	University of Wisconsin-Madison
9/01 - 9/04	Director, Engine Research Center	University of Wisconsin-Madison
7/93 - 1/99	Professor	Mechanical Engineering, University of Wisconsin-Madison
9/89 - 7/93	Associate Professor	Mechanical Engineering, University of Wisconsin-Madison
2/85 - 8/89	Staff Research Engineer	General Motors Research Laboratories, Warren, MI
6/83 - 2/85	Senior Research Engineer	General Motors Research Laboratories, Warren, MI
9/80 - 6/83	Research Staff Member	Princeton University, Princeton, New Jersey
9/78 - 9/80	Associate Research Scientist	Courant Institute of Mathematical Sciences, New York University
2/74 - 9/78	Research Assistant	Princeton University, New Jersey

## ***Honors and Awards:***

ETH Zurich Aurel Stodola Medal Laureate

Nov 09, 2016

SAE Myers award: Wissink, M., and Reitz, R.D., "Direct Dual

Apr 12, 2016

Fuel Stratification, a Path to Combine the Benefits of RCCI and PPC," SAE Int. J. Engines 8(2):2015.

SAE John H. Johnson award for "Outstanding leadership in research in diesel engines"

Apr 12, 2016

Best paper: Investigating Fuel Condensation Processes in Low Temperature Combustion Engines (ICEF2014-5458), by Qiu. L. and Reitz, R.D.

Oct 11, 2015

2014 SAE John Johnson (ERC - PhD ME 64) Award: Outstanding Research in Diesel Engines: Hessel, R., Reitz, R.D., Musculus, M., OConnor, J., and Flowers, D., "A CFD Study of Post Injection Influences on Soot Formation and Oxidation under Diesel-Like Operating Conditions," SAE paper 2014-01-1256.	Apr 11, 2015
SAE Myers award: Splitter, D., Wissink, M., DeVescovo, D., and Reitz, R.D., "Improving the understanding of Intake and Charge effects for increasing RCCI engine efficiency," SAE Int. J. Engines 7(2):2014	Apr 11, 2015
2013 SAE Horning memorial award (co-author of SAE 2011-01- 1182, but ineligible since also received award in 2012)	Jun 18, 2013
DOE Vehicle Technologies R&D Program Award	2012
ASME Internal Combustion Engine Award	2011
Institute for Liquid Atomization and Spray Systems (ILASS- Americas) William Robert Marshall Award (with student N. Abani)	May 18, 2010
SAE Horning Memorial Award (with students D.A. Splitter, R. Hanson)	2010
Best Paper Award, ASME ICE Fall Conf. (with T. Lachaux, M. Musculus, S. Singh)	2009
UW-Madison, College of Engineering, Byron Bird Award for Excellence in Research Publication	2008
ASME Fellow	2006
SAE Arch T. Colwell Award (with student M. Subramaniam and sponsor M. Ruman)	2005
ASME Soichiro Honda Medal	2004
Wisconsin Idea Fellow, University of Wisconsin System	2004
SAE Forest R. McFarland Awards	2004
Best Paper Award, ASME ICE Fall Conference (with students P. Senecal, D. Montgomery)	2000
Appointed Wisconsin Distinguished Professor	1999
Society of Automotive Engineers (SAE) Fellow	1998
SAE Forest R. McFarland Awards	1998
SAE Horning Memorial Award (with students Z. Han, G. Hampson, A. Uludogan)	1997
Institute for Liquid Atomization and Spray Systems (ILASS- Americas) William Robert Marshall Award (with student M. Patterson)	1995
Myers-Uyehara Fund Meritorious Paper Award (with student S.- C. Kong)	1994
SAE Distinguished Speaker Award	1992
SAE Excellence in oral presentation award	1991
SAE Horning Memorial Award (with student J. Naber)	1989
SAE Excellence in oral presentation award	1988
Daniel and Florence Guggenheim Fellowships	1974
MSc(Eng) awarded with Distinction, BSc(Eng) with Honors and Class Medal in Fluids	

## ***Other Awards:***

Nelson Institute for Environmental Studies' Climate Leadership Challenge - <a href="http://www.sage.wisc.edu/clc/">http://www.sage.wisc.edu/clc/</a> (Students: S. Kokjohn, R. Hanson, D. Splitter)	Apr 21, 2010
SAE Outstanding Speaker Award (Student Yu Shi)	2009
SAE Outstanding Speaker Award (Student Neerav Abani)	2008
ILASS best student paper (student H. Snyder)	1998
SAE Outstanding Speaker Award (student A. Lippert)	1997

## ***Professional Activities:***

Review committee, Argonne National Labs, Energy and Global Security Directorate	December 01, 2014 - December 03, 2014
Editor-in-Chief, Frontiers Journal of Engines and Automotive Engineering	2014
Editorial Board Member International Journal of Powertrains	2012 - present
Argonne National Lab EESA review committee	November 06, 2011
Wayne State University, Mechanical Engineering Department Review Committee	February 14, 2011
Editorial Board Member, FUEL journal	2011 - present
Editorial Board member, Journal of Combustion	2010 - 2011
Honorary Editor, Journal of Automotive Safety and Energy	2010 - present
Director, Diesel Engine Research Consortium, University of Wisconsin-Madison	2009 - present
Member Board of Directors, Reaction Design	2006 - 2013
Scientific subcommittee, 19th Int. Conference on Efficiency, Cost, Optimization, Simulation and Environmental Impact of Energy Systems (ECOS-2006) Greece	2006
Colloquium co-chair, 31st International Symposium on Combustion, Univ. Heidelberg, Germany	2006
Advisory Committee, Conference on Thermodynamic Processes in Diesel Engines, Spain	2006 - present
Member Intl. Scientific Committee, Spray-05 Symposium on Heat and Mass Transfer in Spray Systems, Turkey	2005
Director, Diesel Emission Reduction Consortium, University of Wisconsin-Madison	2004 - 2009
Advisory Committee Int. Conference on Vehicles, Alternative Fuel Systems and Environmental Protection, Ireland	2004 - 2006
Advisory Committee, Conference on Thermodynamic Processes in Diesel Engines, Spain	2004
Live sound engineer for Oremus	2004 - present
Organizing Committee 8th ICLASS Conference, Sorrento, Italy	2003
Advisory Board Member, JSME Intl. Journal: Series B - Fluids and Thermal Engineering	2002 - 2010
Advisory Committee, Conference on Thermodynamic Processes in Diesel Engines, Spain	2002
Advisory Committee, Conference on Thermodynamic Processes in Diesel Engines, Spain	2000

Organizing Committee 7th ICLASS Conference, Pasadena, USA	2000
SAE Arch T. Colwell best paper award selection committee member	1999 - 2001
Editor (American continent) and co-founder International Journal of Engine Research, IMechE	1999 - present
Co-Founder, Partner, Wisconsin Engine Research Consultants, LLC (W-ERC)	1999 - present
Organizing Committee 7th ICLASS Conference, Seoul, Korea	1997
SAE Annual Congress Technical Session co-Organizer 'Diesel Fuel Injection and Sprays'	1994 - 2006
Organizing Committee 6th ICLASS Conference, Rouen, France	1994
Editorial Board Member, Atomization and Sprays Journal, Acting Editor	1994 - present
Co-organizer KIVA and Engine Modeling User's Group Meetings	1991 - present
Founding Editor and Co-editor of KIVA User's Group Newsletters Vols.1-17	1990 - present
Past-Chairman, ILASS-Americas, Chairman, Vice Chair, Treasurer, Secretary	1989 - 2005

### ***Research Interests:***

Combustion, gas dynamics, heat transfer, fluid dynamics, sprays, chemical kinetics, pollutant emissions, engine performance, computer modeling of engines and sprays.

### ***Consulting Activities:***

Dow Chemical	2011
Procter & Gamble	2009
Engine Simulation Partners	2008 - 2014
Thomas Magnete	2007
Reaction Design, Board of Directors	2006 - 2013
Finnegan, Henderson, Farabow, Garrett & Dunner, LLP, Expert	2006 - 2007
US Navy Research Advisory Committee, Arlington, VA	2005
Johnson Outdoors, Inc.	2005
S.C. Johnson Wax	2004 - 2007
Catalytica Energy Systems, Inc., Diesel Board of Directors	2003 - 2009
Ford Motor Company	2002 - 2003
Columbian Chemicals	2002
Wisconsin Engine Research Consultants, LLC , co-founder	2002 - present
OMC Outboard Marine Corporation, IL	1998 - 1999
Combustion Research and Flow Technology (CRAFT), PA	1997 - 1998
ThoughtVentions, CT	1997
AVL, Graz, Austria	1997
General Motors Research Laboratories, Warren, MI	1996 - 1997
Detroit Diesel Corp	1996
FIAT Central Research, Turin, Italy	1996
Cummins Engine Co., Columbus, IN	1995 - 1996

Exxon Research Corp, Anandale, N.J.,	1995
National Institute of Standards and Technology (NIST), Gaithersburg, MD	1993
Nissan Motor Co., Yokosuka, Japan	1992
General Motors Research Laboratories, Warren, MI	1992
Southwest Research Institute, San Antonio, TX	1991 - 1992
Advanced Fuel Research, Hartford, CT	1991 - 1992
Caterpillar, Inc., Peoria, Ill.	1989 - 1993
Komatsu Ltd., Oyama, Japan	1981 - 1982
Physics International, San Leandro, California	1978

### ***Review Activities (partial list):***

Communications on Pure and Applied Mathematics, The Combustion Institute, Combustion Science and Technology, Combustion and Flame, American Institute of Aeronautics and Astronautics Journals, National Science Foundation, Society of Automotive Engineers Transactions, American Society of Mechanical Engineers Journals, Physics of Fluids, Army Research Office, Journal of Aerosol Science, Applied Optics, Atomization and Sprays, Journal of Fluid Mechanics, Computers & Fluids, DOE/SBIR, National Research Council, Journal of Multiphase Flows, Journal of Computational Physics, International Journal of Heat and Mass Transfer.

### ***Summary of Research Program:***

Professor Reitz's major research interest is in the area of internal combustion engines. He oversees several engine laboratories. In addition, he develops advanced computer models for predicting engine performance. His heavy-duty diesel engine laboratory features a Caterpillar 3401E single-cylinder test engine that is equipped with prototype fuel injection systems. His research was the first to demonstrate that the use of multiple injections can give significant emissions reductions in these engines. Multiple injections are now being implemented by all major diesel engine manufacturers. His recent work on diesel/gasoline dual fuel compression ignition has attracted much interest since it has demonstrated significant improvements in fuel economy while meeting stringent emissions mandates, without the need for exhaust after-treatment.

His high-speed engine laboratory features an automotive-size diesel engine with advanced electronically controlled fuel injection systems capable of multiple injections. His experimental spray research focuses on fuel drop breakup and atomization phenomena, and has revealed new understandings about the mechanisms of high-speed drop breakup. His research has pioneered the use of computational fluid dynamics to understand basic physical processes and he has developed practical methods for reducing engine pollutant emissions and improving fuel economy.

Professor Reitz's sponsored research funding currently is about \$1M/year, with major sponsorship from the DOE/Sandia laboratories, Caterpillar, GM and Ford. He is former Director of the Engine Research Center and is co-director of the ERC's Diesel Engine Research Consortium (DERC), which currently has ~35 industrial members and government

labs. His research group currently includes 1 Staff members, 1 post-doctoral student and 1 MS and 5 Ph.D. graduate students. He also supervises international visiting scientists.

Prof. Reitz has received many awards for his research. His Byron Bird award citation from the College of Engineering states: 'Professor Reitz's spray modeling approach has quickly gained a worldwide acceptance as a robust modeling approach for atomization and sprays. A testimony of the quality of his work is demonstrated by the fact that all commercial computational fluid dynamics software, as well as all open-source computational fluid dynamics software used for modeling two-phase, chemically reactive flows have incorporated Professor Reitz's spray modeling approach.' Professor Reitz's engine spray and combustion computer models are now used routinely at virtually all major engine companies, as well as government labs and universities internationally. In addition, he has working relationships with leading code vendors for the use of his models in commercial codes.

Professor Reitz's modeling work includes the pioneering use of genetic algorithms for engine design optimization. This work has been featured in the mainstream press, including: The New York Times, Business Week, The London Times, Dallas Morning News, The Financial Times, National Public Radio, Discovery Headline News, MSNBC, and CNN. His recent dual-fuel (Gasoline-diesel 'Cocktail') experimental work has been featured by USA Today, Times of India, Milwaukee Journal Sentinel, Wisconsin Radio Network, WKOW Channel 27 TV Madison, WI, CBC Canadian Broadcast Co. News, Hart Energy Publishing, Designfax, Science Daily, Eurekalert, Physics Today Magazine, Chemistry Times, and a host of other online forums and blogs.

In 1998 Professor Reitz was appointed Fellow of the Society of Automotive Engineers, and he was appointed Wisconsin Distinguished Professor in 1999. He was appointed ASME Fellow in 2006. He served as Chairman of the Institute of Liquid Atomization and Spraying Systems (ILASS-Americas) from 1999-2002. In 1999, he co-founded and serves as Editor (American continent) of the International Journal of Engine Research, which is published in association with the Institution of Mechanical Engineers in cooperation with JASME. He is also the Specialty Editor-in-Chief of the new open access Frontiers Journal of Engine and Automotive Engineering. Professor Reitz has also served on the Editorial Board of the Atomization and Sprays Journal and the Journal FUEL. He served on the SAE Colwell Award Committee and as an SAE Session-Organizer at the annual Congress Diesel Fuel Spray Technology session. He is consultant to many industries, has lectured widely and has won major research awards, including the Soichiro Honda Medal and the University of Wisconsin Byron Bird Award for excellence in research publication (2008).

The SOICHIRO HONDA MEDAL recognizes an individual for an outstanding achievement or a series of significant engineering contributions in developing improvements in the field of personal transportation. This medal was established in 1983 in recognition of Soichiro Honda's exemplary achievements in the field of personal transportation. The citation reads: 'awarded to Prof. R.D. Reitz for seminal contributions to the understanding and modeling of turbulence, sprays and combustion chemistry relative to the performance and emissions from diesel, spark-ignition and HCCI engines; for technological innovations in fuel injection systems; and for computation methods defining future diesel combustion systems and advanced engine controls for low emissions.'

In 2011 Prof. Reitz was awarded the The ASME INTERNAL COMBUSTION ENGINE



AWARD, which is given in recognition of eminent achievement or distinguished contribution over a substantial period of time, which may result from research, innovation or education in advancing the art of engineering in the field of internal combustion engines. The citation reads 'awarded to ROLF D. REITZ, Ph.D., Wisconsin Distinguished Professor of mechanical engineering, University of Wisconsin-Madison, for long-term contributions to the physics of liquid fuel spray atomization, 3-D numerical modeling of combustion, and combustion system optimization; for demonstrating that multiple injectors reduce emissions in diesel engines; and for the discovery of the reactivity controlled compression ignition strategy for high-efficiency, low-emissions engine combustion.'

In 2012 Prof. Reitz received the 2012 DOE VEHICLE TECHNOLOGIES R&D AWARD whose citation states: 'In recognition of innovative combustion strategies leading to significant improvements in engine efficiency.'

In 2016 Prof. Reitz was awarded the SAE John H. Johnson award for 'outstanding leadership in research in diesel engines.'

In 2016 Prof. Reitz was named the Aurel Stodola Medal Laureate at ETH Zurich, Switzerland with citation 'His research foundations have led to cleaner, more efficient engines.'

## ***Teaching:***

### **Courses Taught:**

<b>Date</b>	<b>Title</b>	<b># Students</b>	<b>Student Eval. (Max. 5.0)</b>
Spring 90	ME 363 Fluid Dynamics	35	3.41
Fall 90	ME 361 Thermodynamics I	33	3.63
Spring 91	ME 362 Thermodynamics II	22	4.29
Spring 91	ME 363 Fluid Dynamics	31	3.73
Fall 91	ME 364 Heat Transfer	43	4.23
Fall 91	ME 491 Mech Eng Projects 1	1	-
Spring 92	ME 563 Intermediate Fluid Mechanics	16	4.64
Fall 92	ME 572 Intermediate Gas Dynamics	12	4.82
Spring 93	ME 563 Intermediate Fluid Mechanics	25	4.14
Fall 93	ME 572 Intermediate Gas Dynamics	18	4.67
Fall 93	ME 999 Advanced Independent Study	1	-
Spring 94	ME 563 Intermediate Fluid Mechanics	38	4.41
Fall 94	ME 572 Intermediate Gas Dynamics	17	4.41
Fall 94	ME 699 Independent Study	1	-
Spring 95	ME 769 Combustion Processes	17	4.59
Fall 94	ME 572 Intermediate Gas Dynamics	17	4.81
Spring 96	ME 563 Intermediate Fluid Mechanics	29	4.25
Fall 96	ME 572 Intermediate Gas Dynamics	8	5.00
Spring 97	ME 563 Intermediate Fluid Mechanics	21	4.74

Spring 97	ME 769 Combustion Processes (Team taught: Foster, Gandhi, Reitz, Rutland)	14	4.58
Fall 97	ME 572 Intermediate Gas Dynamics	18	4.41
Spring 98	ME 563 Intermediate Fluid Mechanics	27	4.09
Fall 98	ME 572 Intermediate Gas Dynamics	12	4.25
Spring 99	ME 769 Combustion Processes	21	4.50
Fall 08	ME 572 Intermediate Gas Dynamics	10	4.23
Spring 09	ME769 Combustion Processes	19	4.47
Fall 09	ME 572 Intermediate Gas Dynamics	14	4.31
Fall 10	ME 572 Intermediate Gas Dynamics	14	4.31
Fall 10	EPD 348-690 Engine Fluid Dynamics	18	4.6
Spring 11	ME769 Combustion Processes	17	4.53
Fall 11	ME 572 Intermediate Gas Dynamics	16	4.13
Fall 99	ME 572 Intermediate Gas Dynamics	12	4.70
Spring 00	NEEP520 2-Phase Flow and Heat Transfer (Team taught with Corradini)	14	4.64
Fall 00	ME 572 Intermediate Gas Dynamics	2	5.00
Spring 01	ME769 Combustion Processes	15	4.29
Fall 01	ME 572 Intermediate Gas Dynamics	14	4.64
Spring 02	ME 520 2-Phase Flow & Heat Transfer (Team taught with Corradini and Shedd)	14	4.25
Fall 02	ME 572 Intermediate Gas Dynamics	16	4.69
Spring 03	ME769 Combustion Processes	26	4.65
Fall 03	ME 572 Intermediate Gas Dynamics	22	4.23
Spring 04	ME 520 2-Phase Flow & Heat Transfer (Team taught with Corradini and Shedd)	11	-
Fall 04	ME 572 Intermediate Gas Dynamics (Team taught with Bonazza)	13	4.23
Fall 04	EPD 690 Engine Fluid Dynamics (Team taught with Rutland)	13	4.25
Spring 05	ME769 Combustion Processes	17	4.47
Fall 05	EPD 690 Engine Fluid Dynamics (Team taught with Rutland)	31	3.61
Fall 05	ME 572 Intermediate Gas Dynamics (Team taught with Bonazza)	6	4.17
Spring 06	ME563 Intermediate Fluid Dynamics	14	4.07
Fall 06	ME 572 Intermediate Gas Dynamics (Team taught with Bonazza)	15	4.53
Spring 07	ME769 Combustion Processes	25	4.16
Fall 07	ME572 Intermediate Gas Dynamics (Team taught with Bonazza)	12	4.08
Fall 07	EPD 690 Engine Fluid Dynamics	26	4.70
Fall 08	ME 572 Intermediate Gas Dynamics	10	4.23
Spring 09	ME769 Combustion Processes	19	4.47
Fall 09	ME 572 Intermediate Gas Dynamics	14	4.31
Fall 10	ME 572 Intermediate Gas Dynamics	14	4.31
Fall 10	EPD 348-690 Engine Fluid Dynamics	18	4.6
Spring 11	ME769 Combustion Processes	17	4.53
Fall 11	ME 572 Intermediate Gas Dynamics	16	4.13
Fall 12	ME 572 Intermediate Gas Dynamics	26	4.12
Spring 13	ME769 Combustion Processes	25	4.36
Fall 13	ME 572 Intermediate Gas Dynamics	24	4.10

Fall 13	EPD 348-690 Engine Fluid Dynamics	25	4.2
Spring 15	ME769 Combustion Processes	20	4.2

### **Outreach Courses:**

Reciprocating Internal Combustion Engines, 2014 Princeton Combustion Energy Frontiers Research Center (CEFRC), Summer Program on Combustion, 15 hr. Course , June 23, 2014 - June 27, 2014

Reciprocating Internal Combustion Engines, 2012 Princeton Combustion Energy Frontiers Research Center (CEFRC), Summer Program on Combustion, 9 hr. Course, June 27, 2012 - June 29, 2012

Short Course 'Spray Systems Technology - Computer Modeling of Sprays', Co-Taught annually at Carnegie Mellon University with N. Chigier and W. Bachalo, 2004

Short course 'Engine Spray Modeling', Michigan State University, June 10, 2003 - June 13, 2003

Short Course 'Multidimensional Modeling of IC Engines', UW - Madison, Co-taught with Prof. C. Rutland, S.-C. Kong, R. Hessel, 2000 - 2005

Video Course NTU/ME572 Intermediate Gas Dynamics, National Technological University, 1997 - present

Short Course 'Spray Systems Technology - Computer Modeling of Sprays', Co-Taught annually at Carnegie Mellon University with N. Chigier and W. Bachalo, 1992 - 2002

### ***University/Departmental Committees:***

Ad-hoc committee to nominate COE Research Associate Dean, 2014

ME Department Prof. Krupenkin, Suresh, Pfefferkorn post tenure review committees, 2014

COE Associate to Full Professor Promotion Advisory Committee (Chair), 2013 - 2015

College of Engineering 10 year Review Committee for ECE Department, 2008

ME department Post Tenure Review Committee - Ghandhi, 2006

College of Engineering Equity and Diversity Committee, 2005 - 2009

ME department Hiring Committee member, 2002 - 2003

ME department Post Tenure Review Committee - Englestad, 2001

ME department Hiring Committee Chair, 2000 - 2001

ME department Planning Committee member, 2000

Elected member of College of Engineering Academic Planning Committee, 1998 - 2001

ME department Post Tenure Review Committee - Foster, 1998

ME department ad hoc committee for new student evaluation form (Chair), 1997  
Campus Faculty Senate Ad Hoc committee on use of student evaluations, 1996 - 1997  
ME department Post Tenure Review Committee (Chair) - Martin, 1996  
ME department Graduate Committee member, 1995 - 2001  
ME department Energy Group Co-ordinator (Chair), 1995 - 1997  
ME department Planning Committee member, 1995 - 1997  
Assistant Professor Mentor Committees - Member (R. Gadh, N. Ferrier, X. Li), 1993 - 2005  
ME departmental Ad Hoc Committee on Post Tenure Review, 1993  
ME department Executive Committee member, 1993 - present  
ME departmental Merit Review Committee, 1992 - 1993  
ME department Undergraduate Student Advisor, 1991 - present

### ***Reviewed Publications and Book Chapters:***

1. McGee, R.S. ; Reitz, R.D., "Extinguishment of Radiantly Augmented Fires with Water Sprays," 15th (International) Symposium Volume on Combustion, The Combustion Institute, Pittsburgh, PA. , 1974
2. Reitz, R.D.; Bracco, F.V., "Studies Toward Optimal Charge Stratification in a Rotary Engine," Combustion Science and Technology, Vol. 12, p. 63, 1976
3. Reitz, R.D.; Bracco, F.V., "On the Dependence of the Spray Angle and Other Spray Parameters on Nozzle Design and Operating Conditions," Society of Automotive Engineers Technical Paper 790494 , 1979
4. Reitz, R.D.; Bracco, F.V., "Ultra-High-Speed Filming of Atomizing Jets," The Physics of Fluids, Vol. 22, p. 1054 , 1979
5. Reitz, R.D., "Computations of Laminar Flame Propagation Using an Explicit Numerical Method," 18th (International) Symposium Volume on Combustion, The Combustion Institute, Pittsburgh, PA. , 1980
6. Reitz, R.D., "A Study of Numerical Methods for Reaction-Diffusion Equations," SIAM Journal on Scientific and Statistical Computing, Vol. 2, p. 95, 1981
7. Reitz, R.D., "One-dimensional Compressible Gas Dynamics Calculations Using the Boltzmann Equation," Journal of Computational Physics, Vol. 42, p. 108, 1981
8. Reitz, R.D.; Bracco, F.V., "Mechanism of Atomization of Liquid Jets," The Physics of Fluids, Vol. 25, p. 1730, and Erratum: Vol. 26, (5), pp. 1376 May 1983., 1982
9. Reitz, R.D.; Bracco, F.V., "Toward the Formulation of a Global Local Equilibrium Kinetics Model for Hydrocarbon Flames," Numerical Methods in Laminar Flame Propagation, Notes on Numerical Fluid Mechanics, N. Peters and J. Warnatz, Eds., Friedr. Vieweg & Sohn, Braunschweig/Wiesbaden, Vol. 6, p. 13, 1982
10. Martinelli, L.; Reitz, R.D.; Bracco, F.V., "Comparisons of Computed and Measured Dense Spray Jets," Book Chapter Dynamics of Flames and Reactive Systems, Progress in Astronautics and Aeronautics, M. Summerfield, Ed., Chapter 5, Vol. 95, p. 484, 1983
11. Reitz, R.D.; Bracco, F.V., "Global Kinetics and Lack of Thermodynamic Equilibrium," Combustion and Flame, Vol. 53, p. 141, 1983

12. Abraham, J.; Reitz, R.D.; Bracco, F.V., "Comparisons of Computed and Measured Pre-mixed Charge Engine Combustion," *Combustion and Flame*, Vol. 60, p. 309, 1985
13. Reitz, R.D.; Bracco, F.V., "Mechanisms of Breakup of Round Liquid Jets," Book Chapter *The Encyclopedia of Fluid Mechanics*, N. Chermisnoff, Ed., Gulf Publishing, Houston, Texas, Vol. 3, Chapter 10, pp. 233-249, 1986
14. Wu, K.-J.; Reitz, R.D.; Bracco, F.V., "Measurements of Drop Size at the Spray Edge near the Nozzle in Atomizing Liquid Jets," *The Physics of Fluids*, Vol. 29, pp. 941-951, 1986
15. Reitz, R.D.; Diwakar, R., "The Effect of Drop Breakup on Fuel Sprays," *Society of Automotive Engineers Technical Paper 860469*, SAE Transactions, Vol. 95, Sect. 3, pp. 218-227, 1986
16. Reitz, R.D.; Diwakar, R., "Structure of High-Pressure Fuel Sprays," *Society of Automotive Engineers Technical Paper 870598*, SAE Transactions Vol. 96, Sect. 5, pp. 492-509, 1987
17. Dodge, L.G.; Rhodes, D.J.; Reitz, R.D., "Comparison of Drop-Size Measurement Techniques in Fuel Sprays: Malvern Laser-Diffraction and Aerometrics Phase/Doppler," *Applied Optics*, Vol. 26, pp. 2144-2154, 1987
18. Reitz, R.D., "Modeling Atomization Processes in High-Pressure Vaporizing Sprays," *Atomisation and Spray Technology*, Vol. 3, pp. 309-337 - OpenAccess link: <https://uwmadison.box.com/AandS>, 1988
19. Naber, J.D.; Reitz, R.D., "Modeling Engine Spray/Wall Impingement," *Society of Automotive Engineers Technical Paper 880107*, SAE Transactions, Vol. 97, Also Horning Memorial Volume, pp. 847-869, 1989., 1988
20. Kuo, T.-W.; Reitz, R.D., "Computation of Premixed-Charge Combustion in Pancake and Pent-roof Engines," *Society of Automotive Engineers Technical Paper 890670*, SAE Transactions, Vol. 98, 1989
21. Reitz, R.D.; Kuo, T.-W., "Modeling of HC Emissions due to Crevice Flows in Premixed-Charge Engines," *Society of Automotive Engineers Technical Paper 892085*, SAE Transactions, Vol. 98, 1989
22. Reitz, R.D., "Effect of Vaporization and Turbulence on Spray Drop Size and Velocity Distributions," *Liquid Particle Size Measurement Techniques: 2nd Volume*, ASTM STP1083, E.D. Hirleman, W.D. Bachalo and P.G. Felton, Eds., American Society for Testing and Materials, Philadelphia, pp. 225-237, 1990
23. Reitz, R.D., "A Photographic Study of Flash-boiling Atomization," *Journal of Aerosol Science*, Vol. 12, pp. 561-569, 1990
24. Reitz, R.D., "Assessment of Wall Heat Transfer Models for Premixed-Charge Engine Combustion Computations," *SAE Paper 910267*, SAE Transactions, Vol. 100, Section 3, *Journal of Engines*, p. 397, 1991
25. Epstein, P.; Reitz, R.D.; Foster, D., "Computations of Two-Stroke Engine Cylinder and Port Scavenging Flows," *SAE Paper 910672*, SAE Transactions, Vol. 100, Section 3, *Journal of Engines*, p. 1014, 1991
26. Gonzalez D., M.A.; Borman, G.L.; Reitz, R.D., "A Study of Diesel Cold Starting using both Cycle Analysis and Multidimensional Calculations," *SAE Paper 910180*, SAE Transactions, Vol. 100, Section 3, *Journal of Engines*, p. 189, 1991
27. Reitz, R.D.; Rutland, C.J., "3-D Modeling of Diesel Engine Intake Flow Combustion and Emissions," *SAE Paper 911789*, SAE Transactions, Vol. 100, Section 3, *Journal of Engines*, pp. 1513-1520, 1991
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## ***Other Publications:***

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### **Patent Applications:**

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- Engine Combustion Control at Low Loads via Fuel Reactivity Stratification, Reitz, R.D.,



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Methods for Controlling Reactivity Controlled Compression Ignition (RCCI) Combustion,” , Reitz, R.D., Hanson, R., Splitter, D. and Kokjohn, S.L., University of Wisconsin WARF Patent Application P110092US01, Dec 01, 2010

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### ***Invited Lectures: (1996 - present)***

1. "Reactivity Controlled Compression Ignition (RCCI) for high-efficiency clean IC engines", Aurel Stodola Lecture, ETH Zurich, <https://www.mavt.ethz.ch/content/dam/ethz/special-interest/mavt/departement-dam/news/documents/ETH-Reitz-11-09-2016.pdf>, November 09, 2016
2. "Reciprocating Internal Combustion Engines", 2014 Princeton Combustion Energy Frontiers Research Center (CEFRC), Summer Program on Combustion, 15 hr. Course, June 23, 2014 - June 27, 2014
3. "Reitz, R.D., “Reactivity Controlled Compression Ignition (RCCI) for ultra-high efficiency IC engine operation with low NO<sub>x</sub> and PM emissions plus transient control”, SAE High Efficiency IC Engine Symposium, Westin Book Cadillac Hotel, Detroit, MI, April 14, 2013 - April 15, 2013
4. "Fuel Reactivity Controlled Compression Ignition (RCCI) for High-Efficiency Internal Combustion Engines ", Princeton University, Department of Mechanical & Aerospace Engineering (MAE) Spring Seminar Series, March 08, 2013
5. "Advanced CI Combustion Technologies for Improved Light Duty Automotive Emissions and Fuel Economy", SAE Emissions Control for Light Duty Automotive Vehicles Symposium, Combustion Engine Technologies and CO<sub>2</sub> and Emissions Challenges, Detroit, MI., January 16, 2013
6. "Advanced Combustion Strategies: A Pathway to High-Efficiency, Clean Internal Combustion Engines", 2012 Energy Summit Panel Session: Efficient Buildings and Vehicles, Madison, WI, October 20, 2012
7. "Reciprocating Internal Combustion Engines", 2012 Princeton Combustion Energy Frontiers Research Center (CEFRC), Summer Program on Combustion: <http://www.princeton.edu/cefr/combustion-summer-school/archived-programs/2012-session/lecture-notes/> , June 27, 2012 - June 29, 2012
8. "Dual Fuel Reactivity Controlled Compression Ignition (RCCI) for In-cylinder NO<sub>x</sub> and

- Soot Reduction ", CTI 4th International Conference on NO<sub>x</sub> Reduction Current and Future Solutions for On- and Off-Road Applications, Detroit, MI, June 19, 2012
9. "Reactivity Controlled Compression Ignition (RCCI) for cleaner, more efficient engines ", North American Association of Chinese Engine Engineers (NAACEE) 2012 Annual Conference, Detroit, MI, April 24, 2012
  10. "A Review of the Development and Application of Spray Combustion Models in the Automotive Industry", Invited Lectures, Imperial College, London , April 16, 2012
  11. "Reactivity Controlled Combustion", Invited lecture, Engineering Professional Development short course, Madison, WI, November 08, 2011
  12. "Gasoline-diesel "cocktail" — a potent recipe for cleaner, more efficient engines", SAE ICE 2011 10th International Conference on Engines and Vehicles, Capri (Napoli), Italy, September 12, 2011
  13. "Fuel Flexibility and Reactivity Controlled Compression Ignition (RCCI)", Argonne National Laboratory - Workshop on Techniques for High-Pressure Combustion, August 29, 2011 - September 01, 2011
  14. "Future Fuels and Reactivity Controlled Compression Ignition (RCCI)", ERC Symposium - Future Engine and their Fuels, Madison, WI, June 08, 2011 - June 09, 2011
  15. "Reactivity Controlled Compression Ignition: A Pathway to High-Efficiency, Clean Internal Combustion Engines ", 5th Annual Nelson Institute Earth Day Panel Session: Innovation in Clean Technology, Madison, WI, April 20, 2011
  16. "Fuel Reactivity Controlled Compression Ignition (RCCI) - A practical Path to High-Efficiency, Ultra-low Emission Internal Combustion Engines ", SAE High efficiency Engine Symposium Invited presentation, Detroit, MI, April 10, 2011
  17. " RCCI and Other Highly Efficient Engine Concepts; Spray Modeling for Fuel Efficiency; Combustion Modeling and Simulation ", Reaction Design Distinguished Speaker Video Series, [http://www.reactiondesign.com/events/open/distinguished\\_speaker\\_series.html](http://www.reactiondesign.com/events/open/distinguished_speaker_series.html), March 01, 2011
  18. "Fuel Reactivity Controlled Compression Ignition: A Pathway to High-Efficiency, Clean Combustion ", SAE Government/Industry Meeting, Washington, DC, January 28, 2011
  19. "Fuel Reactivity Controlled Compression Ignition (RCCI) for High-Efficiency, Ultra-Low Emission Internal Combustion Engines", William C. Reynolds Memorial Seminar, Stanford University, October 27, 2010
  20. "High Efficiency Fuel Reactivity Controlled Compression Ignition (RCCI) Combustion", 16th Directions in Engine-Efficiency and Emissions Research (DEER) Conference Detroit, Michigan, Invited Panelist, September 28, 2010
  21. "The Reactivity Controlled Compression Ignition Engine: Simulating Performance in a Changing Fuel Environment", 3rd Multi-Agency Coordinating Committee (MACCCR) Fuel Summit Review, Invited Presentation, September 20, 2010
  22. "High-Efficiency, Ultra-Low Emission Combustion via Fuel Reactivity Controlled Compression Ignition (RCCI)", Ford Research and Innovation Center, Invited Presentation, August 23, 2010
  23. "Toward the 60+% Thermal Efficiency IC Engine", Invited panel presentation, SAE

Congress, Detroit, MI [[watch video of presentation](https://reitz.me.wisc.edu/https-only/cae-auth/Presentations/sae-dual-fuel.html)], April 13, 2010

24. "High-Efficiency, Ultra-Low Emission Combustion in a Compression Ignition Engine via Fuel Reactivity Control, or, Blending gasoline and diesel to create the most efficient and cleanest engine ", Invited presentation, Mechanical Engineering Departmental Seminar Series, University of Michigan, Ann Arbor, November 06, 2009
25. "Blending gasoline and diesel to create the most efficient and cleanest engine", First Look Forum for early Stage Investors, UW Partnership Training Center, Madison, WI, September 03, 2009
26. "High-Efficiency, Ultra-Low Emission Combustion in a Heavy-Duty Engine via Fuel Reactivity Control", Invited presentation, 15th Diesel Engine-Efficiency and Emissions Research (DEER) Conference, Dearborn, MI, August 03, 2009 - August 06, 2009
27. "Improving Fuel Efficiency with Fuel-Reactivity-Controlled Combustion", Engine Research Center Symposium - Reducing Fuel Consumption: Solutions and Prospects, Madison, WI, June 10, 2009 - June 11, 2009
28. "Study of Diesel Spray Primary Breakup", Invited Presentation, Argonne National Labs , May 06, 2009
29. "State of the Art in Spray Modeling", Invited Presentation, Procter & Gamble, Cincinnati, OH , April 01, 2009
30. ""Multi-dimensional Modeling of IC Engines with Advanced Spray and Chemistry Models,"", Invited Presentation, Bridging the Gap Seminar Series, Argonne National Labs, June 11, 2008
31. ""Internal Combustion Engine Modeling and Design Optimization,"", Invited Plenary lecture, ILASS Americas, 21st Annual Conference on Liquid Atomization and Spray Systems, Orlando, Florida, May 18, 2008 - May 21, 2008
32. "Engine Design Optimization Using CFD", Plenary lecture, 12th SIAM International Conference on Numerical Combustion (NC08) , Monterey, CA, March 31, 2008 - April 02, 2008
33. "Internal Combustion Engine Design Optimization using CFD", Invited plenary lecture, ICE2007 8th Intl. Conf. on Engines for Automobiles, Capri, Naples. <http://www.sae-na.it/ICE2007lectures.html> , September 17, 2007
34. "Advanced CFD Modeling for Internal Combustion Engine Design Optimization", Plenary Lecture, CD Adapco Japan CAE Solutions Conference, Yokohama, Japan, May 31, 2007
35. "CFD Modeling of Diesel Combustion", Invited Presentation, Reaction Design Model Fuel Consortium Meeting, San Francisco, November 19, 2006 - November 21, 2006
36. "Status of Diesel Combustion Modeling", Invited presentation, DOE BES Basic Research Needs Workshop, Arlington, VA, October 30, 2006
37. "CFD Modeling of Low Emissions Diesel Engine Combustion Processes", Invited Seminar, Mechanical Science and Engineering Department, University of Illinois Urbana-Champaign, October 24, 2006
38. "Low Temperature Combustion and Diesel Emission Reduction Research", 12th Diesel Engine Emission Reduction Conference, Detroit, MI, August 24, 2006

39. "Modeling of Diesel Combustion", Invited Presentation, Cummins Worldwide TSFE Conference, Cummins, Columbus, IN, May 18, 2006
40. "CFD Modeling of Diesel HCCI", SAE Homogeneous Charge Compression Ignition Combustion Symposium, Grand Hotel, Lund, Sweden, September 18, 2005 - September 20, 2005
41. "Computational Fluid Dynamics Modeling of Diesel Engine Combustion and Emissions", 11th Department of Energy Diesel Engine Emissions Reduction Conference, Palmer House Hilton, Chicago, Illinois, August 21, 2005 - August 25, 2005
42. "Interaction of Engines and Fuels", Naval Research Advisory Committee Panel Meeting, Arlington, VA, June 15, 2005
43. "Modeling Liquid Jet Atomization with Application to Engines", Science & Engineering Council Invited Seminar, S.C. Johnson & Sons, Inc., Racine, WI, January 15, 2004
44. "Recent Developments in IC Engine CFD Modeling with Application to Engine Design Optimization", Pennsylvania State University Mechanical Engineering Department invited seminar, November 20, 2003
45. "Overview of IC Engine CFD Modeling with Application to Engine Design Optimization", SAE Powertrain and Fluid Systems Conference and Exhibition, Pittsburgh, Pa, Keynote lecture: Thursday, October 30, 2003
46. "Diesel HCCI Research Directions", SAE Powertrain and Fluid Systems Conference and Exhibition, Pittsburgh, Pa, HCCI Panel presentation, Thursday, October 30, 2003
47. "Engine Fuel Droplet High Pressure Vaporization Modeling", Invited Presentation at Topical Workshop on Gas Turbine/Rocket/Engine Sprays, ILASS-2003, Monterey, CA, May 18, 2003 - May 21, 2003
48. "Optimization of IC Engine Design for Reduced Emissions using CFD Modeling", Invited Keynote Lecture, THIESEL 2002 Conference on Thermo- and Fluid-Dynamic Processes in Diesel Engines, University of Valencia, Spain, September 10, 2002 - September 13, 2002
49. "Current Status of Engine Combustion Modeling with Application to Optimization of IC Engine Design", Invited Keynote Lecture, Joint International Combustion Symposium, Kauai, Hawaii, September 10, 2001 - September 12, 2001
50. "Spray and Combustion Modeling in Gasoline Direct Injection Engines", Invited Keynote Lecture, 8th International Conference on Liquid Atomization and Spraying Systems, ICLASS-2000, Pasadena, CA., July 16, 2000 - July 20, 2000
51. "Optimization of Diesel Engine Performance using Genetic Algorithms and CFD", Princeton University, Combustion Seminar Series, December 16, 1999
52. "Controlling D.I. Diesel Engine Emissions Using Multiple Injections and EGR", UIC Mechanical Engineering Seminar Series, University of Illinois at Chicago, November 12, 1999
53. "Sources of PM in Diesel Combustion and the NOx/PM Tradeoff", Corning's Diesel Workshop, Corning, N.Y., September 27, 1999 - September 29, 1999
54. "Developments in Spray Modeling in Diesel and Direct-Injection Gasoline Engines", Keynote Lecture, Multidimensional simulation of Engine internal flows Conference, IFP, Rueil-Malmaison, Paris, France, December 03, 1998
55. "CFD Modeling of Improve Diesel Engines", ERCOFTAC-Seminar series, RWTH

University, Aachen, Germany, December 02, 1998

56. "Using Spray, Combustion and Emissions CFD Models to Improve Diesel Engine Performance", Princeton University, MAE Combustion Seminar Series, September 18, 1998
57. "Use of Multiple Injections and EGR for Emissions Control in D.I. Diesel Engines", ME903 Seminar, University of Wisconsin-Madison, January 21, 1998
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