

# CURRICULUM VITA -- RICHARD M. LUEPTOW

Professor

Co-Director, Master of Product Development

Charles Deering McCormick Professor of Teaching Excellence, Emeritus

Department of Mechanical Engineering

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## Research Interests

*Instrumentation:* Calibration methods for hot-wire anemometry. Application of hearing aid microphones to measure wall pressure in turbulent boundary layers. Analysis of microphone resolution in wall pressure measurement. Development of acoustic sensors for the determination of gas composition. Application of Particle Image Velocimetry to granular flows.

*Separation Processes:* Measurements of two-phase Taylor Couette flow in a rotating filter separator. Simultaneous measurement of particle motion and fluid velocity using Pulsed Light Velocimetry. Development of a rotating reverse osmosis system.

*Taylor-Couette Flow:* Investigation of the stability of Taylor-Couette flow with a superimposed axial flow and a porous inner wall boundary condition. Fundamental measurements of the velocity field in Taylor-Couette flow. Theoretical stability of Taylor-Couette flow with axial flow and radial flow or particles.

*Granular Flow:* Measurement techniques and physics of granular flows, particularly in rotating drums. Mixing and segregation in granular flows.

*Sprays:* Measurements of the velocity and droplet size distribution in fire sprinkler sprays.

*Acoustics:* Theoretical prediction of attenuation in gas mixtures based on quantum mechanics and kinetic theory.

## Academic Experience

*Professor*, Dept. of Mechanical Engineering, Northwestern Univ., Evanston, IL (2002-present).

*Co-Director*, Master of Product Development Program, Northwestern Univ., Evanston, IL (2001-present).

*Associate Professor*, Dept. of Mechanical Engineering, Northwestern Univ., Evanston, IL (1995-2002).

*Assistant Professor*, Dept. of Mechanical Engineering, Northwestern Univ., Evanston, IL (1988-1995).

*Lecturer*, Dept. of Mechanical and Energy Engineering, Univ. of Lowell, Lowell, MA (Spring, 1988).

*Lecturer* (part-time), Dept. of Orthodontics, Forsyth Dental School, Harvard Univ., Boston, MA (Fall, 1987).

*Lecturer* (part-time), Dept. of Mechanical Eng., Northeastern Univ., Boston, MA (Winter, 1983).

## Industrial Experience

*Summer Faculty Program*, Argonne National Laboratory, Argonne, IL (Summer 1996)

*IPA*, (consultant) US Naval Undersea Warfare Center, New London, CT (Summer, 1991, 1992, 1993).

*Fellow*, US Navy/ASEE Summer Faculty Research Program, Naval Underwater Systems Center, New London, CT (Summer, 1988).

*Senior Research Engineer*, Haemonetics Corp., Braintree, MA (1986-1987).

*Research Engineer*, Haemonetics Corp., Braintree, MA (1980-1983).

## Academic History

ScD in Mechanical Engineering, 1986, Massachusetts Institute of Technology, Cambridge, MA.

Thesis Topic: Experimental investigation of the velocity field for a thick turbulent boundary layer on a circular cylinder in axial flow. Work involved hot-wire anemometry, development of specialized

instrumentation, computer-controlled data acquisition, computer analysis of data, and flow visualization.  
(Advisors: JH Haritonidis, P Leehey)

SM in Mechanical Engineering, 1980, Massachusetts Institute of Technology, Cambridge, MA.

Thesis Topic: Experimental analysis of External Cardiac Assist, a counter-pulsative pressurization of the legs of a patient to assist the failing heart. Work involved design and experimentation using a hydraulic model of the human circulatory system.

(Advisors: AH Shapiro, R Kamm)

BS in Engineering, 1978, Michigan Technological University, Houghton, MI.

Concentration in Mechanical Engineering/Engineering Mechanics.

### **Awards**

National Institutes of Health, National Research Service Award, 1978-1980.

Northwestern University Associated Student Government Faculty Honor Roll, 1989.

Northwestern University McCormick School of Engineering and Applied Science "Teacher of the Year," 1991, 2002.

Society of Automotive Engineers Teetor Educational Award, 1993.

American Society for Engineering Education Dow Outstanding Young Faculty Award, 1993.

Charles Deering McCormick Professor of Teaching Excellence, chaired professorship, 2000-2002.

William M. Carey Award from the National Fire Protection Research Foundation for the Most Outstanding Presentation at the Suppression and Detection Research Application Symposium, 2002.

William M. Carey Award from the National Fire Protection Research Foundation for the Most Outstanding Presentation at the Suppression and Detection Research Application Symposium, 2003.

Space Act Award from the NASA Inventions and Contributions Board for Rotating Reverse Osmosis, 2004.

### **Professional Activities**

#### *Lead Organizer:*

58<sup>th</sup> Annual meeting of the American Physical Society, Division of Fluid Dynamics, November, 2005, Chicago, IL.

#### *Organizer and Host:*

12<sup>th</sup> International Couette Taylor Workshop, September, 2001, Evanston, IL.

#### *Co-organizer:*

ASME Symposium on Flow Noise Modeling, Measurement, and Control, December 1-6, 1991, Atlanta, GA.

ASME Symposium on Flow Noise Modeling, Measurement, and Control, November 28-December 3, 1993, New Orleans, LA.

ASME Symposium on Flow Noise Modeling, Measurement, and Control, November 12-17, 1995, San Francisco, CA.

#### *Reviewer:*

AICHe Journal  
Applied Scientific Research  
ASME Fluids Engineering Division  
ASME J. Fluids Engineering  
ASME J. Heat Transfer  
ASME Winter Annual Meeting  
Chemical Engineering Science  
Computers and Fluids  
Desalination  
Experiments in Fluids  
Journal of Biomedical Engineering  
Journal of Fluid Mechanics  
Journal of Membrane Science  
International Journal of Heat and Mass Transfer  
National Aeronautics and Space Administration  
National Institutes of Health  
National Science Foundation  
Petroleum Research Fund

Physical Review E  
Physical Review Letters  
Physics of Fluids  
Theoretical and Computational Fluid Dynamics  
Water Research

*Member:*

American Physical Society  
American Society for Engineering Education  
American Society of Mechanical Engineers  
Society of Automotive Engineers

*International Collaborations:*

Summer 1998 (10 weeks): ZARM, Universitat Bremen, Germany for lectures and collaboration with Dr. Christoph Egbers on spherical Couette flow experiments (funded by DAAD).

April 2001 (2 weeks): Dépt Modélisation Numérique (L3M), Université Aix-Marseille II for collaboration with Dr. Patrick Bontoux on modeling Taylor Couette flow in short cylinders.

June-July 2002-2005 (17 weeks total): Dépt Modélisation Numérique (L3M), Université Aix-Marseille II for collaboration with Dr. Patrick Bontoux on modeling Taylor Couette flow in short cylinders. Visiting appointment funded by CNRS.

2004-2005: Collaboration with Dr. Antje Brucks at ZARM, Universitat Bremen, Germany (research program funded by Universitat Bremen)

*Registered Professional Engineer* (Massachusetts).

*Consultant:* US Naval Undersea Warfare Center (turbulence), biomedical devices, plastics extrusion, consumer products, design, and separation processes.

**Refereed Journal Papers**

1. "Behavior of granular flow under variable g-levels," Brucks, A, Ottino, JM and Lueptow, RM, in preparation for Nature, 2005.
2. "Geometric effects of mixing in 2D granular tumblers using discrete models," Cisar, SE, Lueptow, RM and Ottino, JM, in preparation for Physical Review E, 2005.
3. "Creeping motion under variable g-levels," Arndt, T, Brucks, A, Ottino, JM and Lueptow, RM, in preparation for Physical Review E, 2005.
4. "Time scales in transition to Taylor Couette flow," Czarny, O, Serre, E, Bontoux, P and Lueptow, RM, in preparation for Physics of Fluids, 2005.
5. "Boundary flow in granular tumblers," Pohlman, NA, Ottino, JM, and Lueptow, RM, submitted to Journal of Fluid Mechanics, 2005.
6. "Fouling in a high pressure, high recovery rotating reverse osmosis system," Pederson, CL and Lueptow, RM, in preparation for Journal of Membrane Science, 2005.
7. "Effect of nanoscale surface properties on macroscale granular flow," Pohlman, N, Ottino, JM and Lueptow, RM, in preparation for Granular Matter, 2005.
8. "The reaction of a fire plume to a droplet spray," Schwille, JA and Lueptow, RM, in revision for Fire Safety Journal, 2005.
9. "The flow field between a fire and a fire sprinkler spray," Schwille, JA and Lueptow, RM, submitted to Fire Technology, 2005.
10. "Surface velocity in three dimensional tumblers," Pohlman, NA, Meier, SW, Lueptow, RM, and Ottino, JM, in revision for Journal of Fluid Mechanics, 2005.

11. "Urease immobilization on an ion exchange textile for urea hydrolysis," Yeon, K-H, Lueptow, RM, to appear in Journal of Chemical Technology and Biotechnology, 2005.
12. "Concentration of colloidal silica suspensions using fluorescence excitation-emission spectroscopy", Yoon, Y, and Lueptow, RM, in revision for Colloid and Surfaces A: Physicochemical and Engineering Aspects, 2005.
13. "The effect of a fire plume on suppression spray droplet motion," Schwille, JA and Lueptow, RM, to appear in Atomization and Sprays, 2006.
14. "Reverse osmosis rejection for ersatz space mission wastewaters," Yoon, Y, and Lueptow, RM, Water Research, 39:3298-3308, 2005.
15. "Regimes of segregation and mixing in combined size and density granular systems: An experimental study," Jain, N, Ottino, JM, and Lueptow, RM, Granular Matter, 7:69-81, 2005.
16. "A simple model of the effect of a fire sprinkler on a buoyant fire plume," Schwille, JA and Lueptow, RM, to appear in Journal of Fire Protection Engineering, 2005.
17. "Removal of organic contaminants by RO and NF membranes," Yoon, Y, and Lueptow, RM, Journal of Membrane Science, 261:76-86, 2005.
18. "Synthesizing primary molecular relaxation processes in excitable gases using a two-frequency reconstructive algorithm," Petculescu, AG, and Lueptow, RM, Physical Review Letters, 94:238301, 2005.
19. "Characterization of fire sprinkler sprays using particle image velocimetry," Sheppard, DT, and Lueptow, RM, Atomization and Sprays, 15:341-362, 2005.
20. "Combined size and density segregation and mixing in non-circular tumblers," Jain, N, Ottino, JM, and Lueptow, RM, Physical Review E, 71:051301-1 to 051301-10, 2005.
21. "Creeping motion in granular flow," Socie, BA, Umbanhowar, P, Lueptow, RM, Jain, N, and Ottino, JM, Physical Review E, 71:031304, 2005.
22. "Dynamics of granular band formation: Parameter space and tilted cylinders," Arndt, T, Siegmann-Hegerfeld, T, Fiedor, SJ, Ottino, JM, and Lueptow, RM, Physical Review E, 71:011306, 2005.
23. "Fine tuning molecular acoustic models: Sensitivity to the Lennard-Jones parameters of polyatomic gas mixtures," Petculescu, A, and Lueptow, RM, Journal of the Acoustical Society of America, 117:175-184, 2005.
24. "Ekman vortices and the centrifugal instability in counter-rotating cylindrical Couette flow," Czarny, O, Serre, E, Bontoux, P and Lueptow, RM, Theoretical and Computational Fluid Dynamics, 18:151-168, 2004.
25. "Rotating membrane filtration and rotating reverse osmosis," Lee, S and Lueptow, RM, Journal of Chemical Engineering of Japan, 37:471-482, 2004 (invited review paper).
26. "Interaction of wavy cylindrical Couette flow with endwalls," Czarny, O, Serre, E, Bontoux, P and Lueptow, RM, Physics of Fluids, 16:1140-1148, 2004.
27. "Effect of interstitial fluid on a granular flowing layer," Jain, N, Ottino, JM, and Lueptow, RM, Journal of Fluid Mechanics, 508:23-44, 2004.
28. "Model predictions and experiments for rotating reverse osmosis for space mission water reuse," Lee, S and Lueptow, RM, Separation Science and Technology, 39:539-561, 2004.
29. "Rotating reverse osmosis for water recovery in space: Influence of operational parameters on RO performance," Lee, S and Lueptow, RM, Desalination, 169:109-120, 2004.

30. "Acoustic attenuation in gas mixtures with nitrogen: Experimental data and calculations," Ejakov, SG, Phillips, S, Dain, Y, Lueptow, RM, Visser, J, Journal of the Acoustical Society of America, 113:1871-1879, 2003.
31. "Interaction between Ekman pumping and the centrifugal instability in Taylor Couette flow," Czarny, O, Serre, E, Bontoux, P and Lueptow, RM, Physics of Fluids, 15:467-477, 2003.
32. "Three dimensional velocity field for wavy Taylor-Couette flow," Akonur, A, and Lueptow, RM, Physics of Fluids, 15:947-960, 2003.
33. "Control of scale formation in reverse osmosis by membrane rotation," Lee, S and Lueptow, RM, Desalination, 155:131-139, 2003.
34. "Diffraction and attenuation of a tone burst in mono-relaxing media," Dain, Y, and Lueptow, RM, Journal of the Acoustical Society of America, 114:1416-1423, 2003.
35. "Theory for a gas composition sensor based on acoustic properties," Phillips, S, Dain, Y and Lueptow, RM, Measurement Science and Technology, 14:70-75, 2003.
36. "Spiral and wavy vortex flows in short counter-rotating Taylor-Couette cells," Czarny, O, Serre, E, Bontoux, P, and Lueptow, RM, Theoretical and Computational Fluid Dynamics, 16:5-15, 2002.
37. "Particle-fluid velocities and fouling in rotating filtration of a suspension," Wereley, ST, Akonur, A, and Lueptow, RM, Journal of Membrane Science, 209:469-484, 2002.
38. "Design parameters for rotating filtration," Schwille, J, Mitra, D, and Lueptow, RM, Journal of Membrane Science, 204:53-65, 2002.
39. "Experimental verification of a model for rotating reverse osmosis," Lee, S and Lueptow, RM, Desalination, 146:353-359, 2002.
40. "Chaotic mixing and transport in wavy Taylor vortex flow," Akonur, A, and Lueptow, RM, Physica D, 167:183-196, 2002.
41. "An experimental study of the flowing granular layer in a rotating tumbler," Jain, N, Ottino, JM, and Lueptow, RM, Physics of Fluids, 14:572-582, 2002.
42. "Hydrodynamic stability of a suspension in Taylor Couette flow," Ali, M, Mitra, D, Schwille, J.A. and Lueptow, RM, Physics of Fluids, 14:1236-1243, 2002.
43. "A model of flapping motion in a plane jet," Atassi, OV, and Lueptow, RM, European Journal of Mechanics/B Fluids, 21:171-183, 2002.
44. "Acoustic attenuation in a three-gas mixture: results," Dain, Y, and Lueptow, RM, Journal of the Acoustical Society of America, 110:2974-2979, 2001.
45. "Non-intrusive measurements in fire sprinkler sprays," Widmann, JF, Sheppard, D, and Lueptow, RM, Fire Technology, 37:297-315, 2001.
46. "Identification of complex flows in Taylor-Couette counter-rotating cavities," Czarny, O, Serre, E, Bontoux, P, and Lueptow, RM, Comptes-Rendus de l'Académie des Sciences Paris, Série IIB - Mécanique / Mechanics, 329:727-733, 2001.
47. "Rotating reverse osmosis filtration for wastewater recovery: Dynamic model for flux and rejection," Lee, S, and Lueptow, RM, Journal of Membrane Science, 192:129-143, 2001.
48. "Membrane rejection of nitrogen compounds," Lee, S, and Lueptow, RM, Environmental Science and Technology, 35:3008-3018, 2001.

49. "Self-organization in granular slurries," Jain, N, Khakhar, DV, Lueptow, RM, and Ottino, JM, Physical Review Letters, 86:3771-3774, 2001.
50. "Reverse osmosis filtration for space mission wastewater: Membrane properties and operating conditions," Lee, S, and Lueptow, RM, Journal of Membrane Science, 182:77-90, 2001.
51. "Acoustic attenuation in three-component gas mixtures--theory," Dain, Y, and Lueptow, RM, Journal of the Acoustical Society of America, 109:1955-1964, 2001.
52. "Stability and experimental velocity field in Taylor Couette flow with an axial and radial flow," Lueptow, RM, Physics of Rotating Fluids, edited by C. Egbers and G. Pfister, Springer-Verlag., 2000, pp. 137-155.
53. "Toward a reverse osmosis membrane system for recycling space mission wastewater," Lee, S, and Lueptow, RM, International Journal for Life Support and Biosphere Science, 7: 251-261, 2000.
54. "Velocity field for Taylor Couette flow with an axial flow," Wereley, ST, and Lueptow, RM, Physics of Fluids, 11:3637-3649, 1999.
55. "PIV for granular flows," Akonur, A, Shinbrot, T, and Lueptow, RM, Experiments in Fluids, 28:183-186, 1999.
56. "Transient positively and negatively buoyant turbulent jets," Pantzloff, L, and Lueptow, RM, Experiments in Fluids, 27:117-125, 1999.
57. "Inertial particle motion in a Taylor Couette rotating filter," Wereley, ST, and Lueptow, RM, Physics of Fluids, 11:325-333, 1999.
58. "Spanwise structure of the wall pressure on a cylinder in axial flow," Bokde, ALW, Lueptow, RM, and Abraham, B, Physics of Fluids, 11:151-161, 1999.
59. "The boundary layer on a slightly yawed cylinder," Bückner, D, and Lueptow, RM, Experiments in Fluids, 25:487-490, 1998.
60. "A model of mixing and transport in wavy Taylor-Couette flow," Rudolph, M, Shinbrot, T, and Lueptow, RM, Physica D, 121:163-174, 1998.
61. "Spatio-temporal character of nonwavy and wavy Taylor Couette flow," Wereley, ST, and Lueptow, RM, Journal of Fluid Mechanics, 364:59-80, 1998.
62. "Hydrodynamic stability of flow between rotating porous cylinders with radial and axial flow," Johnson, EC, and Lueptow, RM, Physics of Fluids, 9:3687-3696, 1997.
63. "Pressure and shear stress measurements at the wall in a turbulent boundary layer on a cylinder," Nepomuceno, HG, and Lueptow, RM, Physics of Fluids, 9:2732-2739, 1997.
64. "Spatio-temporal development of wall pressure events in turbulent wall-bounded flow," Lueptow, RM, European Journal of Mechanics B: Fluids, 16:191-210, 1997.
65. "Flow in a rotating membrane plasma separator," Lueptow, RM and Hajiloo, A, American Society for Artificial Internal Organs (ASAIO) Journal, 41:182-188, 1995.
66. "Mixing of two solutions combined by gravity drainage," Lueptow, RM, Smith, KB, and Mockros, LF, Journal of Pharmaceutical Science and Technology, 49:132-139, 1995.
67. "Transducer resolution and the turbulent wall pressure spectrum," Lueptow, RM, Journal of the Acoustical Society of America, 97:370-378, 1995.

68. "Wall pressure and coherent structures in a turbulent boundary layer on a cylinder in axial flow," Snarski, SR and Lueptow, RM, Journal of Fluid Mechanics, 286:137-171, 1995.
69. "Acoustic sensor for determining combustion properties of natural gas," Lueptow, RM and Phillips, S, Measurement Science and Technology, 5:1375-1381, 1994.
70. "Azimuthal velocity in supercritical circular Couette flow," Wereley, ST, and Lueptow, RM, Experiments in Fluids, 18:1-9, 1994.
71. "Circular Couette flow with pressure-driven axial flow and a porous inner cylinder," Min, K and Lueptow, RM, Experiments in Fluids, 17:190-197, 1994.
72. "Hydrodynamic stability of viscous flow between rotating porous cylinders with radial flow," Min, K and Lueptow, RM, Physics of Fluids, 6:144-151, 1994.
73. "Student participation, faculty involvement, and costs in large-scale automotive design projects," Lueptow, RM, Journal of Engineering Education, 83:182-184, 1994.
74. "Wall shear stress and velocity in a turbulent axisymmetric boundary layer," Wietrzak, A and Lueptow, RM, Journal of Fluid Mechanics, 259:191-218, 1994.
75. "Stability of axial flow in an annulus with a rotating inner cylinder," Lueptow, RM, Docter, A, and Min, K, Physics of Fluids A: Fluid Dynamics, 4:2446-2455, 1992.
76. "Near-wall streaky structure in a turbulent boundary layer on a cylinder," Lueptow, RM and Jackson, CP, Physics of Fluids A: Fluid Dynamics, Brief Communications, 3:2822-2824, 1991.
77. "Sedimentation of a suspension in a centrifugal field," Lueptow, RM and Hübner, W, Journal of Biomechanical Engineering, 113:485-491, 1991.
78. "The turbulent boundary layer on a cylinder in axial flow," Lueptow, RM, AIAA Journal, Synoptic, 28:1705-1706, 1990.
79. "Computer-aided calibration of X-probes using a look-up table," Lueptow, RM, Breuer, KS, and Haritonidis, JH, Experiments in Fluids, 6:115-118, 1988.
80. "The structure of the turbulent boundary layer on a cylinder in axial flow," Lueptow, RM and Haritonidis, JH, Physics of Fluids, 30:2993-3005, 1987.
81. "The eddy viscosity in a turbulent boundary layer on a cylinder," Lueptow, RM and Leehey, P, Physics of Fluids, Brief Communications, 29:4232-4233, 1986.
82. "The thick, axisymmetric turbulent boundary layer: Mean and fluctuating velocities," Lueptow, RM, Leehey, P, and Stellingner, T, Physics of Fluids, 28:3495-3505, 1985.
83. "Circulatory model studies of external cardiac assist," Lueptow, RM, Karlen, JM, Kamm, RD and Shapiro, AH, Cardiovascular Research, 15:443-455, 1981.
84. "Study of four modes of counterpulsative external cardiac assist (ECA)," Lueptow, RM, Karlen, JM, Kamm, RD and Shapiro, AH, Transactions of American Society for Artificial Internal Organs, 27:576-581, 1981.

### **Books**

1. Graphics Concepts, Lueptow, RM, Prentice-Hall, 2000 (84 pages).
2. Graphics Concepts with Pro/ENGINEER, Lueptow, RM, Steger, J, and Snyder, M, Prentice-Hall, 2001 (278 pages [first 84 pages are identical to Graphics Concepts]).

3. Graphics Concepts with SolidWorks, 2<sup>nd</sup> Edition, Lueptow, RM and Minbirole, M, Prentice-Hall, 2004 (217 pages). This book is distributed with the *Student Edition of SolidWorks*.
4. Learning SolidWorks, 2<sup>nd</sup> Edition, Lueptow, RM and Minbirole, M, Prentice-Hall, 2002 (220 pages).

**Refereed Papers in ASME Bound Volumes** (*These papers are journal length and are peer-reviewed.*)

1. "Particle motion in Taylor Couette flow," Wereley, ST, and Lueptow, RM, ASME OED-Vol. 14:73-79, 1997.
2. "Transient character of positively and negatively buoyant turbulent jets," Pantzloff, L, and Lueptow, RM, ASME OED-Vol. 14:81-87, 1997.
3. "Laminar jet flow into a dead-end tube," Eckmann, DM, Frerichs, TA, Fogg, NR, Lueptow, RM, ASME FED-237:667-672, 1996.
4. "Local wall pressure gradient events in turbulent wall-bounded flow," Lueptow, RM, Flow Noise Modeling, Measurement, and Control, ASME NCA-19/FEC-230:75-85, 1995.
5. "Normal and shear stresses in an axisymmetric turbulent boundary layer on a cylinder," Nepomuceno, HG, and Lueptow, RM, Flow Noise Modeling, Measurement, and Control, ASME NCA-19/FEC-230:119-128, 1995.
6. "Wall pressure transducer spatial resolution," Lueptow, RM, Flow Noise Modeling, Measurement, and Control, ASME NCA-15/FED-168:49-55, 1993.
7. "The fluctuating wall shear stress in the turbulent boundary layer on a cylinder in axial flow," Wietrzak, A and Lueptow, RM, Flow Noise Modeling, Measurement, and Control, ASME NCA-11/FED-130:69-75, 1991.

**Patents**

1. "Acoustic natural gas fuel sensor," Phillips, S and Lueptow, RM, Patent No. 5537854, 23 July 1996.
2. "Disposable manifold and valve," Plaisted, R and Lueptow, RM, Patent No. 4946434, 7 August 1990.
3. "Apparatus for collecting, storing, and dispensing frozen blood plasma," Lueptow, RM, Patent No. 4480751, 6 November 1984.
4. "Blood donation unit and method of use," Schoendorfer, DW, Lueptow, RM, and Schiff, J, Patent No. 4425114, 10 January 1984.
5. "Blood processing system for cell washing," Lueptow, RM and Peterson, JJ, Patent No. 4482342, 13 November 1984.

**Edited Volumes**

1. 12<sup>th</sup> International Couette Taylor Workshop, Lueptow, RM (editor), 2001.
2. Flow Noise Modeling, Measurement, and Control, Farabee, TM, Keith, WL, and Lueptow, RM (editors), ASME NCA-19/FEC-230, 1995.
3. Flow Noise Modeling, Measurement, and Control, Farabee, TM, Keith, WL, and Lueptow, RM (editors), ASME NCA-Vol. 15/FED-Vol. 168, 1993.
4. Flow Noise Modeling, Measurement, and Control, Farabee, TM, Keith, WL, and Lueptow, RM (editors), ASME NCA-Vol. 11/FED-Vol. 130, 1991.

**Workshops**

1. "Unleashing creative potential," Lueptow, RM, Ruiz, F, Dix, R, 2nd Annual National Collegiate Inventors and Innovators Alliance National Conference, March, 1998, Washington, DC.

**Technical Reports, Proceedings Papers & Other Publications** (*peer-reviewed papers are italicized*)

1. *"Reverse osmosis filtration for ersatz space mission wastewaters," Yoon, Y and Lueptow, RM, SAE 2005 International Conference on Environmental Systems (ICES), Rome, Italy, July 2005, paper #2005-01-2802.*
2. *"Preliminary results for an ultrasonic gas monitoring system," Petculescu, A and Lueptow, RM, SAE 2005 International Conference on Environmental Systems (ICES), Rome, Italy, July 2005, paper #2005-01-2876.*
3. *"Preliminary investigation of generating electricity from wastewater via a single-compartment microbial fuel cell," Marcus, A, Lueptow, RM, and Rittmann, BE, SAE 2005 International Conference on Environmental Systems (ICES), Rome, Italy, July 2005, paper #2005-01-3112.*
4. "Water reclamation for a manned Mars mission using high pressure rotating reverse osmosis," Pederson, C, Yoon, Y and Lueptow, RM, 43<sup>rd</sup> AIAA Aerospace Sciences Meeting, Reno, NV, January 2005, paper #AIAA-2005-0536.
5. *"High pressure rotating reverse osmosis for wastewater recycling in long term space missions," Pederson, C and Lueptow, RM, SAE 2004 International Conference on Environmental Systems (ICES), Colorado Springs, CO, July 2004, paper # 2004-01-2488.*
6. "Rotating reverse osmosis for long-term space missions," Yoon, Y, Pederson, C, Neal, R, Lee, S and Lueptow, RM, Water Environment Membrane Technology, June 2004, Seoul, Korea.
7. "Rotating reverse osmosis for wastewater recovery," Pederson, C, Yoon, Y, Neal, R, Lee, S and Lueptow, RM, 9<sup>th</sup> World Filtration Congress, April, 2004, New Orleans, LA.
8. "The interaction of a buoyant fire plume with a droplet spray," Schwille, JA and Lueptow, RM, 3<sup>rd</sup> Joint Meeting of the US Sections of the Combustion Institute, March, 2003, Chicago, IL.
9. "A novel RO membrane technique based on Taylor-Couette flow for scale control in water desalination," Lee, S and Lueptow, RM, American Water Works Association Membrane Conference, March, 2003, Atlanta, GA.
10. "Space mission wastewater recovery system using rotating reverse osmosis: Process simulation," Lee, S and Lueptow, RM, SAE 2002 International Conference on Environmental Systems (ICES), San Antonio, TX, July, 2002.
11. "Acoustic Attenuation in Three-Component Gas Mixtures – Part 1: Theory," Dain, Y, Lueptow, RM, Ejakov, SG, and Visser, JH, Ford Research Laboratory Technical Report SRR-2001-0271, Dec. 11, 2001.
12. "Stability of a suspension in Taylor Couette flow," Ali, M, Mitra, D, and Lueptow, RM, Proceedings of ICFDP7: Seventh International Conference of Fluid Dynamics and Propulsion, December, 2001, Sharm El-sheik, Egypt.
13. "Development of a rotating reverse osmosis membrane system for recycling space mission wastewater," Lee, S, and Lueptow, RM, American Filtration and Separations Society Conference, May 2001, Tampa, FL.
14. "Operating parameters for rotating Taylor-Couette filtration," Schwille, J, Mitra, D, and Lueptow, RM, American Filtration and Separations Society Conference, May 2001, Tampa, FL.
15. "Understanding sprinkler sprays: Trajectory analysis," Sheppard, D, Gandhi, P, and Lueptow, RM, Fire Research and Safety 15<sup>th</sup> Meeting of the US-Japan Panel, San Antonio, TX, Vol. 1 Proceedings, Bryner, SL (editor), March, 2000, pp. 281-288.
16. "Predicting sprinkler water distribution using particle image velocimetry", Sheppard, D, Gandhi, P, and Lueptow, RM, Fire Suppression and Detection Research Application Symposium, Proceedings, February, 2000, pp. 354-364.

17. "Particle distribution in rotating filtration," Wereley, ST and Lueptow, RM, in *Advances in Filtration and Separation Technology*, Vol. 13a, Proceedings of American Filtration and Separations Society Annual Technical Conference, Leung, W and Ptak, T (editors), April 1999, pp. 252-258.
18. "*Acoustic natural gas fuel quality sensor*," Lueptow, RM, Phillips, S, and Oczkowski, M, *SAE Technical Paper 950529*, 1995.
19. "Fluid mechanics of a rotating filter separator," Lueptow, RM, in *Advances in Filtration and Separation Technology*, Vol. 9, Proceedings of American Filtration and Separations Society Annual Technical Conference, Choi, K-J (editor), April 1995.
20. "Feasibility of an acoustic approach to measuring natural gas fuel composition" Lueptow, RM, and Phillips, S, Gas Research Institute Technical Report, GRI-94/0135, 1994.
21. "*The NGV Challenge--Student participation, faculty involvement, and costs*," Lueptow, RM, *SAE Technical Paper 940556*, 1994.
22. "Wall pressure events in turbulent wall-bounded flow," Lueptow, RM, Turbulent Flows, ASME FED-188: 65-69, 1994.
23. "Wall pressure events from the direct numerical simulation of a turbulent, wall-bounded flow," Lueptow, RM, US Naval Undersea Warfare Center Technical Report 10,481, 1994.
24. "1993 SAE Natural Gas Vehicle Challenge: Northwestern University Design Report," Student Section of SAE at Northwestern University, RM Lueptow, advisor. Report submitted to NGV Challenge organizers.
25. "1992 SAE Natural Gas Vehicle Challenge: Northwestern University Design Report," Student Section of SAE at Northwestern University, RM Lueptow, advisor. In Enhancing Natural Gas Vehicle Technology, SAE Special Publication, SP-929, pp. 149-156, 1992.
26. "Computational fluid flow analysis--General purpose software," Lueptow, RM, Computers in Mechanical Engineering, 6(5):10-17, 1988.
27. "The turbulent boundary layer on a cylinder in axial flow," Lueptow, RM, US Naval Underwater Systems Center Technical Report 8387, 1988.

#### **Presentations, Abstracts, and Posters**

1. "Use of rotating reverse osmosis to control scale formation for wastewater reuse," Lee, S and Lueptow RM, The International Congress on Membranes, August, 2005, Seoul, Korea.
2. "Rotating granular flow: Changing the Froude number by varying g," Brucks, A, Oelse, H., Odenback, S., and Lueptow, RM, Annual Symposium of the German Physical Society (DPG), Berlin, Germany, March, 2005.
3. "Macroscale effects of nanoscale surface roughness in granular flow," Pohlman, NA, Ottino, JM, and Lueptow, RM, 57<sup>th</sup> Annual Meeting of the Division of Fluid Dynamics, American Physical Society, Seattle, WA, November, 2004.
4. "Creeping motion in granular flow," Socie, BA, Umbanhowar, PB, Lueptow, RM, Jain, N, and Ottino, JM, 57<sup>th</sup> Annual Meeting of the Division of Fluid Dynamics, American Physical Society, Seattle, WA, November, 2004.
5. "Segregation and mixing in combined size and density granular systems," Jain, N, Ottino, JM, and Lueptow, RM, 57<sup>th</sup> Annual Meeting of the Division of Fluid Dynamics, American Physical Society, Seattle, WA, November, 2004.
6. "Granular band formation: Fill-level, rotational speed, and tilted cylinders," Lueptow, RM, Siegmann-Hegerfeld, Arndt, T, Fiedor, SJ, and Ottino, JM, 57<sup>th</sup> Annual Meeting of the Division of Fluid Dynamics, American Physical Society, Seattle, WA, November, 2004.

7. "Rotating RO for water purification: Earth and space applications," U.S. Congressional Expeditionary Unit Water Purification (EUWP) Program International Workshop, London, UK, October, 2004 (invited speaker).
8. "Granular Flow: What's the difference between a wet and dry system?" Washington University, St. Louis, MO, September 2004.
9. "Granular Flow: What's the difference between a wet and dry system?" Ecole Polytechnique Universitaire de Marseilles, France, July 2004.
10. "Granular Flow: What's the difference between a wet and dry system?" University of Bremen, Germany, July 2004.
11. "Mixing, endwalls, and space applications of Taylor Couette Flow," University of Aix-Marseille II, July 2004.
12. "Rotating reverse osmosis for wastewater reuse," Lueptow, RM, Yoon, Y, and Pederson, C, Strategic Research to Enable NASA's Exploration Missions Conference, June 2004, Cleveland, OH.
13. "Rotating reverse osmosis for controlling silica fouling," Lee, S, Lueptow, RM, Water Environment—Membrane Technology, June 2004, Seoul, Korea.
14. "Rotating reverse osmosis for wastewater recovery," Pederson, C, Yoon, K, Neal, R, Lee, S, and Lueptow, RM, Water Environment—Membrane Technology, June 2004, Seoul, Korea.
15. "Granular Flow: What's the difference between an wet and dry system?" University of Illinois-Chicago, May 2004.
16. "Rotating reverse osmosis for wastewater recovery: First generation prototype," Pederson, C, Yoon, K, Neal, R, Lee, S, and Lueptow, RM, 9<sup>th</sup> World Filtration Congress, April 2004, New Orleans, LA.
17. "Wastewater treatment using rotating reverse osmosis," Lueptow, RM. NASA Advanced Life Support Teleconference, March, 2004.
18. "Rotating reverse osmosis for space mission water recovery: First generation prototype," Pederson, C, Lee, S, and Lueptow, RM, Habitation 2004 Conference, January 2004, Orlando, FL.
19. "Real-time acoustic gaseous process control monitor," Lueptow, RM, Habitation 2004 Conference, January 2004, Orlando, FL.
20. "Infrared imaging to quantify fire suppression by sprays," Schwille, JA, Gandhi, P, and Lueptow, RM, Fire Suppression and Detection Research Application Symposium, January, 2004, Orlando, FL.
21. "Droplet motion and evaporation in fire suppression," Schwille, JA, Gandhi, P, and Lueptow, RM, Fire Suppression and Detection Research Application Symposium, January, 2004, Orlando, FL.
22. "Effect of Interstitial fluid on a flowing granular layer," Jain, N, Ottino, JM, and Lueptow, RM, AIChE 2003 Annual Meeting, November 2003, San Francisco, CA.
23. "Measuring sub-nanometer pore sizes in membranes," Lueptow, RM and Lee, S, 56<sup>th</sup> Annual Meeting of the Division of Fluid Dynamics, American Physical Society, November, 2003, Newark, NJ.
24. "Interaction of the Ekman layer with vortical flow in a short Couette-Taylor Cell," Czarny, O, Serre, E, Bontoux, P, and Lueptow, RM, 13<sup>th</sup> International Couette Taylor Workshop, July 2003, Barcelona, Spain.
25. "Mass transfer in rotating reverse osmosis based on Couette Taylor flow," Lueptow, RM and Lee, S, 13<sup>th</sup> International Couette Taylor Workshop, July 2003, Barcelona, Spain.

26. "Mixing, endwalls, and space applications of Taylor Couette Flow," University of Bremen, Germany, June 2003.
27. "Mixing and transport in Taylor Couette flows," Lueptow, RM, Akonur, A, and Wereley, ST, SIAM Conference on Applications of Dynamical Systems, May 2003, Snowbird, UT.
28. "Fire plume and fire sprinkler interaction," Lueptow, RM, Gandhi, P, and Schwille, J, Fire Suppression and Detection Research Application Symposium, January, 2003, Orlando, FL. *Winner of Best Paper Award.*
29. "Acoustic attenuation for gaseous process monitoring," Lueptow, RM, and Dain, Y, Bioastronautics Investigators' Workshop, January 2003, Galveston, TX.
30. "Rotating reverse osmosis for wastewater recovery in space," Lueptow, RM, and Lee, S, Bioastronautics Investigators' Workshop, January 2003, Galveston, TX.
31. "Interaction of the Ekman layer with Taylor vortices," Lueptow, RM, Czarny, O, Serre, E, and Bontoux, P, 55<sup>th</sup> Annual Meeting of the Division of Fluid Dynamics, American Physical Society, November, 2002, Dallas, TX.
32. "Interaction between a fire plume and a fire sprinkler spray," Schwille, J, and Lueptow, RM, 55<sup>th</sup> Annual Meeting of the Division of Fluid Dynamics, American Physical Society, November, 2002, Dallas, TX.
33. "Quantitative measurements of wet and dry granular flow," Jain, N, Ottino, JM, and Lueptow, RM, AIChE 2002 Annual Meeting, November 2002, Indianapolis, IN.
34. "Rotating reverse osmosis: Effect of operating conditions," Lee, S and Lueptow, RM, AIChE 2002 Annual Meeting, November 2002, Indianapolis, IN.
35. "Taylor-Couette instabilities in short confined cavities", Czarny, O, Serre, E, Bontoux, P, and Lueptow, RM, Joint Madrid-Bayreuth Seminar on Non-Equilibrium Phenomena and Phase Transitions in Complex Systems, September, 2002, Avila, Spain.
36. "Dry and wet granular flow in a rotating tumbler," University of Bremen, Germany, August 2002.
37. "Spray characteristics of fire sprinklers," University of Aix-Marseille II, July 2002.
38. "Rotating reverse osmosis for wastewater recovery," Lee, S and Lueptow, RM, The International Congress on Membranes and Membrane Processes, July, 2002, Toulouse, France.
39. "Rotating reverse osmosis system: Model development and experimental verification," Lee, S and Lueptow, RM, 13<sup>th</sup> Meeting of the North American Membrane Society, May 2002, Long Beach, CA.
40. "Measuring and calculating sprinkler water distribution," Sheppard, D, Lueptow, RM, Fire Suppression and Detection Research Application Symposium, January, 2002, Tampa, FL. *Winner of Best Paper Award.*
41. "Measured and predicted acoustic attenuation in two-component gas mixtures," Ejakov, SJ, Phillips, S, Dain, Y, Lueptow, RM, and Visser, JH, 142<sup>nd</sup> Meeting of the Acoustical Society of America, December, 2001, Fort Lauderdale, FL.
42. "Vortical flows in short counter-rotating Couette-Taylor cells," Lueptow, RM, Czarny, O, Serre, E, and Bontoux, P, 54<sup>th</sup> Annual Meeting of the Division of Fluid Dynamics, American Physical Society, November, 2001, San Diego, CA.
43. "Rotating reverse osmosis for wastewater recovery in manned space missions," Lueptow, RM, and Lee, S, 17<sup>th</sup> Annual Meeting of the American Society for Gravitational and Space Biology, November, 2001, Alexandria, VA.

44. "Spiral and wavy vortex flows in short counter-rotating Couette-Taylor cells," Czarny, O, Serre, E, Bontoux, P, and Lueptow, RM, 12<sup>th</sup> International Couette Taylor Workshop, September 2001, Evanston, IL.
45. "Rotating reverse osmosis system based on Taylor-Couette flow," Lee, S and Lueptow, RM, 12<sup>th</sup> International Couette Taylor Workshop, September 2001, Evanston, IL.
46. "Anti-fouling mechanisms in rotating filtration," Schuille, JA, Mitra, D, and Lueptow, RM, 12<sup>th</sup> International Couette Taylor Workshop, September 2001, Evanston, IL.
47. "Dynamics and chaos in wavy vortex flow," Akonur, A and Lueptow, RM, 12<sup>th</sup> International Couette Taylor Workshop, September 2001, Evanston, IL.
48. "Diffraction correction and attenuation of high-frequency acoustic pulses in a relaxing medium," Dain, Y and Lueptow, RM, 141<sup>st</sup> Meeting of the Acoustical Society of America, June 2001, Chicago, IL.
49. "Nitrogen rejection by reverse osmosis membranes for wastewater recycling," Lee, S and Lueptow, RM, 12<sup>th</sup> Meeting of the North American Membrane Society, May 2001, Lexington, KY.
50. "Non-intrusive measurements in fire sprinkler sprays using phase Doppler interferometry and particle image velocimetry," Widmann, J, Sheppard, D, and Lueptow RM, Fire Suppression and Detection Research Application Symposium, February 2001, Orlando, FL.
51. "Rotating membrane water purification for long-term human presence in space," Lueptow, RM, Lee, S, Mitra, D, and Schuille, J, Bioastronautics Investigator Workshop, January 2001, Galveston, TX.
52. "Hydrodynamic stability of a suspension in Taylor Couette flow," Mitra, D, Ali, ME, and Lueptow, RM, 53rd Annual Meeting of the Division of Fluid Dynamics, American Physical Society, November, 2000, Washington, DC.
53. "Particle paths in wavy Taylor-Couette flow," Akonur, A, and Lueptow, RM, 53rd Annual Meeting of the Division of Fluid Dynamics, American Physical Society, November, 2000, Washington, DC.
54. "Pattern formation in slurries," JM Ottino, Jain, N, Khakhar, D, and Lueptow, RM, 53rd Annual Meeting of the Division of Fluid Dynamics, American Physical Society, November, 2000, Washington, DC.
55. "Spray distribution of fire sprinklers," Sheppard, D, and Lueptow, RM, 53rd Annual Meeting of the Division of Fluid Dynamics, American Physical Society, November, 2000, Washington, DC.
56. "Velocity in a flowing layer in a rotating tumbler," Lueptow, RM, Jain, N, and Ottino, JM, 53rd Annual Meeting of the Division of Fluid Dynamics, American Physical Society, November, 2000, Washington, DC.
57. "Results of attenuation calculations for a three-component gas mixture," Dain, Y, and Lueptow, RM, 139th Meeting of the Acoustical Society of America, December, 2000, Newport, CA.
58. "Two-plane velocity field in wavy Taylor-Couette flow," Akonur, A, and Lueptow, RM, ICTAM 2000, August, 2000.
59. "Particle tracking techniques for measuring granular flow," Jain, N, Akonur, A, Hill, K, Ottino, JM, and Lueptow, RM, ICTAM 2000, August, 2000.
60. "Toward a reverse osmosis membrane system for recycling space mission wastewater," Lee, S, and Lueptow, RM, 4<sup>th</sup> International Conference on Life Support and Biosphere Science, August, 2000, Baltimore, MD.
61. "Preliminary design guidelines for rotating Taylor-Couette filtration," Schuille, JA, Mitra, D, and Lueptow, RM, 4<sup>th</sup> International Conference on Life Support and Biosphere Science, August, 2000, Baltimore, MD.

62. "Development of design parameters for rotating filtration," Mitra, D, Schwille, JA, and Lueptow, RM, 11<sup>th</sup> Annual Conference of the North American Membrane Society, May, 2000, Boulder, CO.
63. "Toward a reverse osmosis membrane system for recycling space mission wastewater," Lueptow, RM, Northwestern University Environmental Engineering Seminar Series, April, 2000.
64. "Toward a reverse osmosis membrane system for recycling space mission wastewater," Lueptow, RM, NASA ALS Teleconference, March, 2000.
65. "Separation via rotating filtration," Lueptow, RM, Purdue University, February, 2000.
66. "Attenuation in tertiary gas mixtures with two relaxing components," Dain, Y, Lueptow, RM, 138<sup>th</sup> Meeting of the Acoustical Society of America, November, 1999, Columbus, OH.
67. "Optical velocimetry methods in granular flows," Lueptow, RM, Jain, N, Akonur, A, Hill, K, 52<sup>nd</sup> Annual Meeting of the Division of Fluid Dynamics, American Physical Society, November, 1999, New Orleans, LA.
68. "Comparison of industrial fire simulator to experimental results," Sheppard, D, Lueptow, RM, 3<sup>rd</sup> International Conference on Fire Research and Engineering, October 1999, Chicago, IL.
69. "Velocity field in the r- $\theta$  plane of wavy cylindrical Couette flow," Akonur, A, Lueptow, RM, 11<sup>th</sup> International Couette-Taylor Workshop, July 1999, Bremen, Germany.
70. "Spherical Couette flow in a medium gap," Lueptow, RM, Boehm, C, Egbers, C, 51<sup>th</sup> Annual Meeting of the Division of Fluid Dynamics, American Physical Society, November, 1998, Philadelphia, PA.
71. "Radial and azimuthal velocity in Taylor Couette flow," Akonur, A, Lueptow, RM, 51<sup>th</sup> Annual Meeting of the Division of Fluid Dynamics, American Physical Society, November, 1998, Philadelphia, PA.
72. "Flapping motion in a 2-D jet," Atassi, OV, and Lueptow, RM, 50<sup>th</sup> Annual Meeting of the Division of Fluid Dynamics, American Physical Society, November, 1997, San Francisco, CA.
73. "Particle motion in a Taylor-Couette filter," Wereley, ST, and Lueptow, RM, 50<sup>th</sup> Annual Meeting of the Division of Fluid Dynamics, American Physical Society, November, 1997, San Francisco, CA.
74. "Velocity field in Couette-Taylor flow with axial flow," Stockert, M, and Lueptow, RM, 10<sup>th</sup> International Couette-Taylor Workshop, July 1997, Paris, France.
75. "Velocity field in wavy circular Couette flow," Wereley, ST, and Lueptow, RM, 10<sup>th</sup> International Couette-Taylor Workshop, July 1997, Paris, France.
76. "Linear stability of rotating Couette flow between porous cylinders with radial and axial flow," Johnson, EC, and Lueptow, RM, 49<sup>th</sup> Annual Meeting of the Division of Fluid Dynamics, American Physical Society, November, 1996, Syracuse, NY.
77. "Mixing in wavy Taylor vortices," Wereley, ST, and Lueptow, RM, 49<sup>th</sup> Annual Meeting of the Division of Fluid Dynamics, American Physical Society, November, 1996, Syracuse, NY.
78. "Spanwise structure of the wall pressure on a cylinder under axial flow," Bokde, ALW, and Lueptow, RM, 49<sup>th</sup> Annual Meeting of the Division of Fluid Dynamics, American Physical Society, November, 1996, Syracuse, NY.
79. "Transients in jet mixing of fluids with different densities," Pantzloff, L, and Lueptow, RM, 49<sup>th</sup> Annual Meeting of the Division of Fluid Dynamics, American Physical Society, November, 1996, Syracuse, NY.
80. "Velocity measurements in rotating Couette flow with axial flow," Stockert, M, and Lueptow, RM, 49<sup>th</sup> Annual Meeting of the Division of Fluid Dynamics, American Physical Society, November, 1996, Syracuse, NY.

81. "Velocity field in wavy vortex flow," Wereley, ST, and Lueptow, RM, 48th Annual Meeting of the Division of Fluid Dynamics, American Physical Society, November, 1995, Irvine, CA.
82. "Wavy Taylor vortex flow: Experimental velocity vectors," Wereley, ST, Lueptow, RM, and Labhsetwar, S, Gallery of Fluid Motion, 48th Annual Meeting of the Division of Fluid Dynamics, American Physical Society, November, 1995, Irvine, CA.
83. "Measurements of velocity fields with application toward two-phase flow in a Taylor-Couette separator," Lueptow, RM, and Wereley, ST, 9th Couette-Taylor Workshop, August 1995, Boulder, CO.
84. "Velocity fields in a rotating filter separator," Wereley, ST, and Lueptow, RM, 1995 International Conference on Emerging Particle-Science Technologies for Environment and Health Improvement, August 1995, Chicago, IL.
85. "Simultaneous wall pressure and wall shear stress measurements beneath a turbulent cylindrical boundary layer," Nepomuceno, HG, and Lueptow, RM, American Physical Society, Division of Fluid Dynamics, 47th Annual Meeting, November 1994, Atlanta, GA.
86. "Wall pressure peak events in wall-bounded turbulent flow," Lueptow, RM, American Physical Society, Division of Fluid Dynamics, 47th Annual Meeting, November 1994, Atlanta, GA.
87. "An experimental study of the stability of rotating Couette-Poiseuille flow with a porous inner cylinder," Min, K and Lueptow, RM, NATO Advanced Research Workshop, 8th Couette-Taylor Meeting, March 1993, Nice, France.
88. "Large-scale automotive design projects--Students, faculty, and costs," Lueptow, RM, Mechanical Engineering Division, 1993 ASEE Annual Conference, June 1993, Urbana, IL.
89. "Resolution of wall pressure transducers and the Corcos correction," Lueptow, RM, American Physical Society, Division of Fluid Dynamics, 46th Annual Meeting, November 1993, Albuquerque, NM.
90. "The effect of transverse wall curvature on the fluctuating wall pressure and the structure of boundary layer turbulence," Snarski, SR and Lueptow, RM, Office of Naval Research Workshop on Non-Equilibrium Turbulence, Tempe, AZ, March 1993.
91. "A LDV investigation of the Taylor vortex phenomenon," Wereley, ST, and Lueptow, RM, American Physical Society, Division of Fluid Dynamics, 45th Annual Meeting, November 1992, Tallahassee, FL.
92. "An experimental study of rotating Couette-Poiseuille flow with a porous inner cylinder," Min, K, and Lueptow, RM, American Physical Society, Division of Fluid Dynamics, 45th Annual Meeting, November 1992, Tallahassee, FL.
93. "Shear stress, pressure, and velocity measurements in the turbulent boundary layer on a cylinder," Lueptow, RM, Wietrzak, A and Snarski, SR, American Physical Society, Division of Fluid Dynamics, 45th Annual Meeting, November 1992, Tallahassee, FL.
94. "The wall shear stress in the boundary layer on a cylinder," Lueptow, RM and Wietrzak, A, US Naval Undersea Warfare Center Tactical Towed Array Technical Exchange, May 1992, New London, CT.
95. "Wall pressure and its relation to turbulence in the boundary layer on a cylinder," Lueptow, RM and Snarski, S, US Naval Undersea Warfare Center Tactical Towed Array Technical Exchange, May 1992, New London, CT.
96. "An experimental study of the stability of axial flow in an annulus with a rotating inner cylinder," Lueptow, RM, Docter, A and Min, K, American Physical Society, Division of Fluid Dynamics, 44th Annual Meeting, November 1991, Tempe, AZ.

97. "Flow in a PLASMACELL rotating membrane separator," Lueptow, RM, and Hajiloo, A, ASAIO Annual Meeting, 37th Annual Meeting, April 1991, Chicago, IL.
98. "Hydrodynamic stability of flow between rotating cylinders with radial flow," Min, K and Lueptow, RM, American Physical Society, Division of Fluid Dynamics, 44th Annual Meeting, November 1991, Tempe, AZ.
99. "The effect of transverse wall curvature on the fluctuating wall pressure and the structure of boundary layer turbulence," Snarski, SR and Lueptow, RM, American Physical Society, Division of Fluid Dynamics, 44th Annual Meeting, November 1991, Tempe, AZ.
100. "The fluctuating wall shear stress in the turbulent boundary layer on a cylinder in axial flow" Wietrzak, A and Lueptow, RM, American Physical Society, Division of Fluid Dynamics, 44th Annual Meeting, November 1991, Tempe, AZ.
101. "Sedimentation of a biosuspension in a centrifugal field," Lueptow, RM and Hübler, W, First World Congress on Biomechanics, September 1990, LaJolla, CA.
102. "Hindered particle settling in a centrifugal field," Lueptow, RM and Hübler, W, American Physical Society, Division of Fluid Dynamics, 42th Annual Meeting, November 1989, Stanford, CA.
103. "Turbulent structures in a boundary layer on a cylinder," Lueptow, RM, and Haritonidis, JH, American Physical Society, Division of Fluid Dynamics, 38th Annual Meeting, November 1985, Tucson, AZ.
104. "Model studies of external cardiac assist by counterpulsation," Lueptow, RM, Karlen, JM, Kamm, RD and Shapiro, AH, 33rd ACEMB, September 1980, Washington, DC.

#### **Northwestern University Activities and Service**

- Advisor:* Northwestern University entry in the SAE Natural Gas Vehicle Challenge (1990-1993)  
Northwestern University Student Section of Society of Automotive Engineers (1991-1993)  
Academic advisor for 8 to 18 undergraduates each year
- Member:* Krebs Professorship Search Committee (2 years)  
McCormick School of Engineering and Applied Science Undergraduate Committee (3 years)  
Mechanical Engineering Graduate Committee (1 year)  
Mechanical Engineering Benchmark Committee (1 year)  
Ad Hoc Committee on a Biomedical Engineering Institute (1 year)  
McCormick Future Committee (1 year)  
Mechanical Engineering Faculty Search Committee (various years)  
McCormick Committee on Academic Standing (current)  
McCormick planning committees for Ford Engineering Design Center (current)  
McCormick ad hoc Committee on Design in the Curriculum (current)  
University Faculty Reappointment, Promotion, Tenure, and Dismissal Appeals Panel (current)
- Chair:* McCormick School of Engineering and Applied Science Teaching Award Committee (1 year)  
Mechanical Engineering Undergraduate Curriculum Committee (3 years)  
Mechanical Engineering Shop Committee (current)
- Other:* Direct supervisor for 3 of the 5 technical employees for the ME Department (current)  
Prepared ME Department ABET Accreditation (1999)  
Co-Director of the Master of Product Development program (2001- )

#### **Research Grants** (sole PI unless otherwise noted)

*Past:*

"Acoustic natural gas composition sensor," DAI Technologies, 1 year, \$27,800.

- "Acoustic Sensors," Ford Motor Company, 2 years, \$100,000.
- "Engineering analysis of a rotating membrane filtration device for blood separation," Whitaker Foundation, 3 years, \$177,900.
- "Engineering Software Tools' course for cooperative education students," Searle Family Grants for Innovative Teaching, Northwestern University, (PI: R. Lueptow, co-PI's: James Conley, Geraldine Garner, Henry Stoll), 1 year, \$11,000.
- "Enhancement of Innovation and Entrepreneurship in Capstone Design," National Collegiate Inventors and Innovators Alliance, 1 year, (PI: R. Lueptow 80%, Co-PI: James Conley 20%), \$10,850.
- "Experimental Data to Model Fire Sprinklers in Warehouses," National Institute of Standards and Technology, 1 year, \$28,592.
- "Innovation and Entrepreneurship in a Multi-Disciplinary Environment," National Collegiate Inventors and Innovators Alliance, 1 year, \$5,000.
- "Intergovernmental Personnel Act -- Cylindrical boundary layers," Naval Underwater Systems Center, four grants of 3 to 9 months duration, \$31,740.
- "International Couette Taylor Workshop Support," Office of Naval Research, 1 year, \$10,000.
- "International Couette Taylor Workshop Support," National Science Foundation, 1 year, \$10,000.
- "Measurements and model for fire sprinkler spray distribution," National Institute of Standards and Technology, 1 year, \$53,888.
- "Measurements of fire sprinkler distribution in a fire plume," National Institute of Standards and Technology, 1 year, \$74,635.
- "Particle motion in rotating filter separation," National Science Foundation, 3 years, \$182,258.
- "Physics of filtration in a rotating filter separator," National Science Foundation, 3 years, \$189,422.
- "Pilot Study: Acoustic attenuation as a real-time gaseous process control monitor", National Aeronautics and Space Administration, 1 year, \$59,543.
- "Rotating Couette-Poiseuille flow with a porous inner wall," Baxter Healthcare Corporation, Fenwal Division, 2.5 years, \$75,710.
- "Rotating Membrane Water Purification for Long Term Human Presence in Space," National Aeronautics and Space Administration, 3 years, \$528,908.
- "SAE Natural Gas Vehicle Challenge," General Motors, Department of Energy, Argonne National Lab, 3 years, \$17,000 plus 1991 full-size GMC pickup truck valued at \$19,000.
- "Spanwise relationship of wall pressure in the boundary layer on a cylinder," Naval Undersea Warfare Center, 3 years, \$96,470.
- "Structures and wall pressure in a cylindrical boundary layer," Office of Naval Research, 4 years, \$159,800.
- "Subcontract: Advanced Sensors for Real-Time Control of Advanced Natural Gas Reciprocating Engine Combustion," Argonne National Laboratory, 1 year, \$24,903.
- "Subcontract to: A Low Cost Acoustic Property Sensor," Department of Energy & Commercial Electronics, 2 years, \$120,009.
- "Surgical dustbuster," National Collegiate Inventors and Innovators Alliance, 1 year, \$17,400.
- "Use of PIV system for investigation of fluid flow", Kohler Co., 1 year, \$14,850.

*Current:*

- "Advancing rotating membrane water purification for human life support in space," National Aeronautics and Space Administration, 3 years, \$510,026.
- "Dynamics of segregation and mixing of granular matter," Department of Energy, with PI Julio Ottino, 4 years, \$456,220.
- "Real-time gaseous process control monitoring based on acoustic properties," National Aeronautics and Space Administration, 2 years, \$381,253.

**Graduate Students**

*Current students:*

- Cindy Pedersen, PhD candidate, Rotating reverse osmosis  
Nick Pohlman, PhD candidate, Granular flow dynamics  
Andrew Marcus, PhD candidate, Membrane microbial fuel cell

*Post-Doctoral scholars sponsored:*

- Arun Bodke (1996), Wall pressure measurement in a boundary layer on a cylinder.

Antje Brucks (2004- ), Granular flow at high g.  
Yefim Dain (1999-2002), Acoustic attenuation in gas mixtures.  
Sangho Lee (1999-2003), Reverse osmosis in a rotating filter.  
Andi Petculescu (2003- ), Acoustic attenuation in gas mixtures.  
Kyeongho Yeon (2003-2004), Urease processing of urea.  
Yeomin Yoon (2003- ), Reverse osmosis in a rotating filter.

*Doctoral students who have completed work:*

Alp Akonur, PhD (2001), Physics of filtration in a rotating membrane separator.  
Oliver Atassi, PhD (1997), Nonlinear interaction between a vortex and a wall-bounded vorticity layer.  
Olivier Czarny, PhD (University of Marseille, 2003), Computational study of Taylor Couette flow  
Nitin Jain, PhD (2004), Granular flow dynamics  
Kyungyoon Min, PhD (1993), Stability and velocity field for circular Couette-Poiseuille flow with radial flow.  
John Schuille, PhD (2004), Interaction between fire plumes and fire sprinkler sprays  
David Sheppard, PhD (2002), Spray characteristics of fire sprinklers.  
Steven Snarski, PhD (1992), Relation between the fluctuating wall pressure and the turbulent structure of a boundary layer on a cylinder in axial flow.  
Steven T Wereley, PhD (1997), Buoyancy forces and Taylor vortex transport in rotating filtration.  
Anthony Wietrzak, PhD (1992), The fluctuating wall shear stress in the turbulent boundary layer on a cylinder in axial flow.

*Master's and visiting students who have completed work:*

Tim Arndt, visiting student (2003), The influence of angular velocity, fill level, and angle of the rotating axis on axial segregation in a rotating tumbler.  
David Brown, MS (1995), The frequency response of a hot-wire shear probe.  
Dominikus Bucker, visiting student (1997), The effect of yaw on the turbulent boundary layer on a cylinder in axial flow.  
Andreas Docter, visiting student (1991), Experimental measurements of the stability of circular Couette-Poiseuille flow.  
Todd Frerichs, MS (1995), Laminar jet flow into a dead-end tube.  
Wolfgang Hübler visiting student, Hindered particle settling in a centrifugal field.  
Patrick Jackson, MS (1990), Flow visualization of a turbulent boundary layer on a moving cylinder.  
Nitin Jain, MS-ChE (2000), Self organization and flow dynamics of granular materials (co-advised with Julio Ottino).  
Eric Johnson, MS (1995), Linear stability of circular Couette flow with axial and radial flow.  
Kenneth Lin, MS (1989), Experimental investigation of vortex shedding from a tapered cylinder.  
Deep Mitra, MS (2000), Hydrodynamic stability of a suspension in cylindrical Couette flow.  
Henry Nepomuceno, MS (1995), Simultaneous wall pressure and shear stress measurements beneath a turbulent cylindrical boundary layer.  
Lars Pantzlaff, visiting student (1996), Study of free jet mixing of liquids with differences in density.  
Lars Pantzlaff, MS (1997), Transients in jet mixing of liquids with different densities.  
Scott Phillips, MS (1994), Acoustic device for measuring the methane number.  
Matthias Rudolph, visiting student (1997), Fluid particle tracking in wavy vortex flow -- a model.  
John Schuille, MS (2001), Design parameters for rotating filtration  
Tanja Siegmann-Hegerfeld, visiting student (2003), The influence of angular velocity, fill level, and angle of the rotating axis on axial segregation in a rotating tumbler.  
Kelly Smith, MS (1993), Solution mixing and stratification in a flexible dual-chambered solution container.  
Ben Socie, MS (ChE, 2003), Core precession in a rotating drum  
Malte Stöckert, visiting student (1997), Circular Couette flow with an axial flow.  
Joel Stuckey, MS (1997), Development of non-contact thermal imaging methods for characterizing advanced ceramics.  
Steven Wereley, MS (1993), A laser Doppler velocimetry investigation of the Taylor vortex problem.

**Courses Taught**

*Northwestern University*

GenEng 205-3 Engineering Analysis III  
ME 241 Fluid Mechanics I

ME 373 Engineering Fluid Mechanics  
ME 395 Special Topics in Automotive Engineering  
ME 395 Engineering Software Tools  
ME 398 Engineering Design  
ME 425-1 Fundamentals of Fluid Dynamics I (graduate course)  
ME 425-2 Fundamentals of Fluid Dynamics II (graduate course)  
ME 434 Random Data and Spectral Analysis (graduate course)  
ME 438 Granular Flows (with J. Ottino) (graduate course)  
ME 512 Mechanical Engineering Seminar (graduate seminar)  
MPD 409 Product Development

*University of Lowell*

Engineering Statics

*Harvard University*

Engineering Mechanics for Orthodontists (graduate seminar course)

*Northeastern University*

Engineering Statics