

July 11, 2022

JULIO M. OTTINO  
*CURRICULUM VITAE*

***Personal***

US citizen<sup>1</sup>, born in La Plata, Argentina.  
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***Education***

Ph.D. in Chemical Engineering, University of Minnesota, 1979.  
Chemical Engineering Diploma, National University of La Plata, Argentina, 1974.  
Executive Program, Kellogg School of Management, 1995.

***Current Position***

Dean, R.R. McCormick School of Engineering and Applied Science, 2005-  
R.R. McCormick Institute Professor, Northwestern University, 2000-  
Walter P. Murphy Professor, Chemical Engineering, Northwestern University, 1991-  
Professor (by courtesy), Mechanical Engineering, Northwestern University, 2000-

***Teaching and Research Positions***

Co-Director, the Northwestern Institute on Complex Systems, 2004-2005.  
Chair, Department of Chemical Engineering, Northwestern University, 1992-2000.  
Professor of Chemical Engineering, Northwestern University, 1991-  
George T. Piercy Distinguished Professor, Department of Chemical Engineering and Materials  
Sciences, University of Minnesota, 1998.  
Senior Research Fellow, Center for Turbulence Research, Stanford University, 1991.  
Professor, Department of Chemical Engineering, University of Massachusetts, Amherst, 1986-1991.  
Chevron Visiting Associate Professor of Chemical Engineering, California Institute of Technology,  
1986.  
Associate Professor, Department of Chemical Engineering, University of Massachusetts, Amherst,  
1983-1986.  
Adjunct Professor, Department of Polymer Science and Engineering, University of Massachusetts,  
Amherst, 1979-1991.  
Assistant Professor, Department of Chemical Engineering, University of Massachusetts, Amherst,  
1979-1983.  
Instructor, Department of Chemical Engineering, University of Minnesota, Minneapolis, 1978-1979.

***Honors and Significant Lectureships***

2023 National Academy of Sciences  
2020 Distinguished Lectures, Hong Kong Institute for Advanced Study (HKIAS), City University  
of Hong Kong (invitation received January 2020; visit postponed).  
2109 Covestro Distinguished Lectureships, Dept. of Chemical and Petroleum Engineering,  
University of Pittsburgh

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<sup>1</sup>Naturalized March 21, 1991, Northampton, Massachusetts.

2018 Founders Award for Outstanding Contributions to the Field of Chemical Engineering, American Institute of Chemical Engineers

2018 William M.W. Mong Distinguished Lecture, University of Hong Kong

2018 John C. Chen Distinguished Lecture, Department of Chemical and Biomolecular Engineering, Lehigh University

2017 Bernard M. Gordon Prize for Innovation in Engineering and Technology Education, National Academy of Engineering

2016 Schlinger Symposium opening plenary address, Chemical Heritage Foundation

2015 SABIC Lectureship Award, Polymer Engineering, University of Akron

2015 Institute of Molecular Engineering Distinguished Lectures, University of Chicago

2014 4<sup>th</sup> KAIST CBE Global Distinguished Lectureship, Korea

2014 2<sup>nd</sup> Thomas H. Chilton Lecture, du Pont Central Research and Development

2013 Creativity in Science and Society, Symposium Celebrating Niels Bohr, Royal Danish Academy of Sciences and Letters, Copenhagen

2013 Alumni Endowed Lectures in Chemical Engineering, UMass-Amherst

2013 Fellow, American Institute of Chemical Engineers

2013 Distinguished Lecture, Chemical Engineering, Syracuse University

2012 Distinguished Research Lecture in Chemical Engineering, Carnegie Mellon University

2012 Eminent Lecturer, National Technical University Singapore

2012 TechniGraphicS Foundation Lecture, IIT Bombay, India

2012 Keynote ASME Design Automation Conference, Chicago

2011 Keynote ASME Dynamics Systems and Control Conference, Washington DC

2010 62<sup>nd</sup> Institute Lecture, American Institute of Chemical Engineers

2008 Fluid Dynamics Prize, American Physical Society

2008 Otto Laporte Lecture, American Physical Society

2008 AIChE 100<sup>th</sup> Anniversary “One Hundred Engineers of the Modern Era”, American Institute of Chemical Engineers.

2008 Plenary  $\mu$ TAS Lecture (12<sup>th</sup> International Conference on Miniaturized Systems for Chemistry and Life Sciences, San Diego).

2007 Pirkey Lecture, University of Texas, Austin

2006 Dean’s Distinguished Lecture, College of Engineering and Mathematical Sciences, University of Vermont

2006 Reilly Lectures University of Notre Dame

2003 Member, American Academy of Arts and Sciences

2002 Ernest W. Thiele Award (AIChE, Chicago section)

2002 Robb Distinguished Lecture in Chemical Engineering Science, Penn State University

2001 William H. Walker Award, American Institute of Chemical Engineers

2001 John S. Guggenheim Fellowship

2001 Paul J. Flory Lecturer, Stanford University

1999 Danckwerts Memorial Lecture, London, England

1997 Member, National Academy of Engineering

1996 Fellow, American Association for the Advancement of Science

1996 Sigma Xi Distinguished Lecturer (1997-1999)

1996 SON Lecture (Foundation for Chemical Research, The Netherlands)

1995 Faculty Honor Roll, Associated Student Government, Northwestern University  
1994 Alpha Chi Sigma Award, American Institute of Chemical Engineers  
1994 William N. Lacey Lectureship in Chemical Engineering, California Institute of Technology  
1994 College of Engineering Centennial Speaker, University of Maryland  
1993 Fellow, American Physical Society, Division of Fluid Mechanics  
1991 Fifth Stanley Corrsin Lectureship in Fluid Mechanics, The Johns Hopkins University  
1989 Finalist Scientific Prize, Art for Science, LV-MH, Paris, France  
1989 Merck Sharp & Dohme Lecturer, University of Puerto Rico  
1988 University Fellow, University of Massachusetts  
1987 Allan P. Colburn Memorial Lectureship, Chemical Engineering, University of Delaware  
1984 Inaugural Presidential Young Investigator Award (NSF)  
1982 Outstanding Junior Faculty Scholar Award (University of Massachusetts)

### ***Selected professional activities***

- Chair, Draper Prize Committee, National Academy of Engineering; Member 2014- vice chair 2017, chair 2019.
- Member NAE's Roundtable Linking Academic Engineering Research/Defense Basic Science.
- Co-Chair (with John Guckenheimer, Mathematics, Cornell University) "*Foundations for Complex Systems: Research in the Physical Sciences and Engineering*" (report from an NSF Workshop, September 2008).
- Member of several NRC committees, Benchmarking Committee, US Chemical Engineering (2007), Committee on the Challenges for the Chemical Sciences (2002-3) Draper Prize Committee (2014-).
- AIChE Chemical Engineering Operating Council, 2002-Benchmarking Committee, US
- Member International Review of Engineering in the UK –EPSRC/Royal Academy of Engineering (2004).
- Member NAE Committee on Membership (2003-2006)
- Founding Editor, *AIChE Journal*, Perspectives (1999-2006); Associate Editor (1994-2006)

### ***Selected boards and advising activities***

- Advisory Board Cultural Data Analytics Open Lab, Tallinn University, Estonia
- Takata Quality Assurance Panel, 2015; [www.takatapanel.com](http://www.takatapanel.com)
- Scientific Board, AkzoNobel, 2010-2013
- Noribachi LLC, Albuquerque, New Mexico, 2008-2010
- Member, International Advisory Board, UC Santa Barbara (2005-2010)
- Unilever, Senior Advisor (1997-2008)
- Dow Chemical (Engineering Sciences Technical Advisory Board, 2000-2004).
- Member program reviews at Cornell, Houston, U.C. Santa Barbara, etc.

### ***CURRENT AREAS OF RESEARCH***

*Granular Dynamics, Mixing – Fluid Dynamics, Segregation and Coarsening, Complex Systems.*

***Publications in Refereed Journals:*** Over 260 publications in refereed journals; ISI *h*-index: 62, Google Scholar *h*-index: 74; book "*The Kinematics of Mixing*" has been cited 3,500 times. Publications have appeared in the following journals:

1. *Advances in Chemical Engineering*
2. *Advances in Complex Systems*
3. *American Institute of Chemical Engineers Journal*
4. *American Journal of Physics*
5. *Annals of Biomedical Engineering*
6. *Annual Review of Fluid Mechanics*
7. *Annual Review of Chemical and Biomolecular Engineering*
8. *Archives for Rational Mechanics and Analysis*
9. *Biotechnology Progress*
10. *Cardiovascular Engineering and Technology*
11. *Chaos*
12. *Chaos, Solitons and Fractals*
13. *Chemical Engineering Communications*
14. *Chemical Engineering Education*
15. *Chemical Engineering Science*
16. *European Journal of Physics*
17. *European Phys. Letters*
18. *Exp. Thermal Fluid Sci.*
19. *Geophysical Research Letters*
20. *Granular Matter*
21. *Industrial Engineering Chemistry Fundamentals*
22. *Industrial Engineering Chemistry Research*
23. *International Journal of Multiphase Flow*
24. *Int. J. Bifurcations and Chaos*
25. *Journal of Chemical Physics*
26. *Journal of Colloid and Interface Science*
27. *Journal of Fluid Mechanics*
28. *Journal of Non-Newtonian Fluid Mechanics*
29. *Lectures in Applied Mathematics*
30. *Macromolecules*
31. *Nature*
32. *Nature Communications*
33. *Nature Physics*
34. *New Journal of Physics*
35. *Philosophical Transactions of the Royal Society of London*
36. *Physics Reports*
37. *Physical Review*
38. *Physical Review Applied*
39. *Physical Review E*
40. *Physical Review Letters*
41. *Physical Review Fluids*
42. *Physical Review Research*
43. *Physics of Fluids and Physics of Fluids A*
44. *Polymer*
45. *Polymer Engineering Science*
46. *Powder Technology*
47. *Proceedings of the National Academy of Sciences of the US*
48. *Proceedings of the Royal Society of London*
49. *SIAM Journal on Applied Dynamical Systems*
50. *Soft Matter*
51. *Science*
52. *Trans IChemE*
53. *Tribology Letters*

### ***Publications in Magazines***

54. *CHEMTECH*
55. *INGENIA*
56. *Scientific American*
57. *The Chronicle of Higher Education*

## **PUBLICATIONS**

### ***Books***

J.M. Ottino, *The Kinematics of Mixing: Stretching, Chaos, and Transport*, Cambridge University Press, Cambridge, England 1989 (xiv, 364 pp., illus., + plates), reprinted 1990, 1997; 2004.

R. Sturman, J.M. Ottino, and S. Wiggins, *Mathematical Foundations of Mixing: The Linked Twist Map as a Paradigm in Applications – Micro to Macro, Fluids to Solids*, Cambridge University Press, Cambridge, England, 2006.

J.M. Ottino with B. Mau, *The Nexus: Augmented Thinking for a Complex World – The New Convergence of Art, Technology, and Science*, MIT Press 2022.

### ***Publications in Refereed Journals, Technical Papers***

J.M. Ottino, W.E. Ranz, and C.W. Macosko, A lamellar model for analysis of liquid-liquid mixing, *Chem. Eng. Sci.*, **34**, 877-890 (1979).

J.M. Ottino and C.W. Macosko, An efficiency parameter for batch mixing of viscous liquids, *Chem. Eng. Sci.*, **35**, 1454-1457 (1980).

J.M. Ottino, Lamellar mixing models for structured chemical reactions and their relationship to statistical models; Macro- and micro-mixing and the problem of averages, *Chem. Eng. Sci.*, **35**, 1377-1391 (1980).

L.J. Lee, J.M. Ottino, W.E. Ranz, and C.W. Macosko, Impingement mixing in reaction injection molding, *Polym. Eng. Sci.*, **20**, 868-874 (1980).

J.M. Ottino, Efficiency of mixing from data on fast reactions in multi-jet reactors and stirred tanks, *AIChE Journal*, **27**, 184-192 (1981).

J.M. Ottino, C.W. Macosko, and W.E. Ranz, Framework for the description of mechanical mixing of fluids, *AIChE Journal*, **27**, 565-577 (1981).

J.M. Ottino and H.T. Davis, Pressure tensor in lamellarly structured fluids, *J. Chem. Phys.*, **74**, 6388-6393 (1981).

J.M. Ottino, Description of mixing with diffusion and reaction in terms of the concept of material interfaces, *J. Fluid Mech.*, **114**, 83-103 (1982).

- K.K. Mohanty, J.M. Ottino, and H.T. Davis, Reaction and transport in disordered composite media: Introduction of percolation concepts, *Chem. Eng. Sci.*, **37**, 905-924 (1982).
- R. Chella and J.M. Ottino, Simplified model for mechanical mixing, diffusion, and reaction in a single screw extruder, *ACS Symp. Ser.*, **196**, 567-578 (1982).
- J.M. Ottino, A mechanical mixing parameter for continuous mixing systems, *AIChE Journal*, **29**, 159-161 (1983).
- R. Chella and J.M. Ottino, Modeling of rapidly-mixed fast-crosslinking exothermic polymerizations I: Adiabatic temperature rise, *AIChE Journal*, **29**, 373-382 (1983).
- J.E. Sax and J.M. Ottino, Transport of small molecules in polymer blends: Application of effective medium theory, *Polym. Eng. Sci.*, **23**, 165-176 (1983).
- J.M. Ottino and R. Chella, Mixing of polymeric liquids: A brief review and recent theoretical developments, *Polym. Eng. Sci.*, **23**, 357-379 (1983).
- J.M. Ottino and N. Shah, Analysis of transient sorption and permeation of small molecules in multiphase polymer systems, *Polym. Eng. Sci.*, **24**, 153-162 (1984).
- R. Chella and J.M. Ottino, The fluid mechanics of mixing in a single screw extruder, *Ind. Eng. Chem. Fundam.*, **24**, 170-180 (1985).
- R. Chella and J.M. Ottino, Conversion and selectivity modifications due to mixing in unpremixed Reactors, *Chem. Eng. Sci.*, **39**, 551-567 (1984).
- J.E. Sax and J.M. Ottino, Influence of morphology on the transport properties of polystyrene/polybutadiene blends: Experimental results, *Polymer*, **26**, 1073-1080 (1985).
- N. Shah, J.E. Sax, and J.M. Ottino, Influence of morphology on the transport properties of polystyrene/polybutadiene blends: Modeling results, *Polymer*, **26**, 1229-1246 (1985).
- R. Chella and J.M. Ottino, Stretching in some classes of fluids motions and asymptotic mixing efficiencies as a measure of flow classification, *Arch. Rat. Mech. Anal.*, **90**, 15-45 (1985).
- D.J. Lin, J.M. Ottino, and E.L. Thomas, A kinetic study of the activated anionic polymerization of  $\epsilon$ -Caprolactam, *Polym. Eng. Sci.*, **25**, 1155-1163 (1985).
- N. Shah and J.M. Ottino, Effective transport properties of random multi-phase composites: Application of renormalization Theory, *Chem. Eng. Sci.*, **41**, 283-296 (1986).
- D.V. Khakhar and J.M. Ottino, A note on the linear vector model of Olbricht, Rallison, and Leal as applied to the breakup of slender axisymmetric drops, *J. Non-Newtonian Fluid Mech.*, **21**, 127-131 (1986).
- D.V. Khakhar and J.M. Ottino, Deformation and breakup of slender drops in linear flows, *J. Fluid Mech.*, **166**, 265-285 (1986).
- W.L. Chien, H. Rising, and J.M. Ottino, Laminar and chaotic mixing in several cavity flows, *J. Fluid Mech.*, **170**, 355-377 (1986).

- D.V. Khakhar, H. Rising, and J.M. Ottino, An analysis of chaotic mixing in two model systems, *J. Fluid Mech.*, **172**, 419-451 (1986).
- D.V. Khakhar and J.M. Ottino, Fluid mixing (stretching) by periodic sequences for weak flows, *Phys. Fluids*, **29**, 3503-3505 (1986).
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- S.D. Fields and J.M. Ottino, Mixing effects during polymerizations by the adiabatic temperature rise technique, *AIChE Journal*, **33**, 157-160 (1987).
- D.V. Khakhar and J.M. Ottino, Breakup of liquid threads in linear flows, *Int. J. Multiphase Flow*, **13**, 71-86 (1987).
- S.D. Fields and J.M. Ottino, Effect of striation thickness distribution on the course of an unpremixed polymerization, *Chem. Eng. Sci.*, **42**, 459-465 (1987).
- S.D. Fields and J.M. Ottino, Effect of stretching path on the course of polymerizations: applications to idealized unpremixed reactors, *Chem. Eng. Sci.*, **42**, 467-477 (1987).
- D.J. Kinning, E.L. Thomas, and J.M. Ottino, Effect of morphology on the transport of small molecule gases in block copolymers, *Macromolecules*, **20**, 1129-1133 (1987).
- S.D. Fields and J.M. Ottino, Effects of segregation on the course of unpremixed polymerizations, *AIChE Journal*, **33**, 959-975 (1987).
- M. Serrano, W.J. MacKnight, E.L. Thomas and J.M. Ottino, Transport-morphology in polybutadiene polyurethanes. 1: Experimental results, *Polymer*, **28**, 1667-1673 (1987).
- M. Serrano, W.J. MacKnight, E.L. Thomas, and J.M. Ottino, Transport-morphology in polybutadiene polyurethanes. 2: Analysis, *Polymer*, **28**, 1674-1679 (1987).
- D.V. Khakhar, J.G. Franjione, and J.M. Ottino, A case study of chaotic mixing in deterministic flows: The partitioned pipe mixer, *Chem. Eng. Sci.*, **42**, 2909-2926 (1987).
- J.G. Franjione and J.M. Ottino, Feasibility of numerical tracking of material lines and surfaces in chaotic flows, *Phys. Fluids*, **30**, 3641-3643 (1987).
- E.M. Sevick, P.A. Monson, and J.M. Ottino, Monte Carlo calculations of cluster statistics in continuum models of composite morphology, *J. Chem. Phys.*, **88**, 1198-1206 (1988).
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- J. M. Ottino, C.W. Leong, H. Rising, and P.D. Swanson, Morphological structures produced by mixing in chaotic flows, *Nature*, **333**, 419-425 (1988) (*cover article*).  
[reprinted in “*Chaos and Nonlinear Dynamics*” edited by R.C. Hilborn and N.B. Tufillaro, American Association of Physics Teachers, College Park, Maryland, 1999.]
- F. J. Muzzio and J.M. Ottino, Coagulation in chaotic flows, *Phys. Rev. A*, **38**, 2516-2524 (1988).
- E.M. Sevick, P.A. Monson, and J.M. Ottino, Clustering and percolation in assemblies of anisotropic particles: Perturbation theory and Monte Carlo simulation, *Phys. Rev. A*, **38**, 5376-5383 (1988).
- J.M. Ottino, The mixing of fluids, *Scientific American*, **260**, 56-67 (1989) (*cover article*).  
[translations appeared in *Pour la Science*, Le mélange des fluides, mensuel **137**, 32-42, Mars 1989, and *Investigacion y Ciencia*, Mezcla de Fluidos, Número **150**, 44-55, Marzo (1989); *Le Scienze*, Il Mescolamento dei Fluidi, n° **247**, 152-161 (1989); *Mischen zäher Flüssigkeiten*, Spektrum der Wissenschaft, März (1989), S66 - 77].
- E.M. Sevick, P.A. Monson, and J.M. Ottino, Morphology and transport using the Ising lattice as a morphology description, *Chem. Eng. Sci.*, **44**, 21-32 (1989).
- H.A. Kusch, J.M. Ottino, and D.M. Shannon, Analysis of impingement mixing-reaction data: Use of a lamellar model to generate fluid mixing information, *Ind. Eng. Chem. Res.*, **28**, 302-315 (1989).
- F. J. Muzzio and J.M. Ottino, Evolution of a lamellar system with diffusion and reaction: A scaling approach, *Phys. Rev. Lett.*, **63**, 47-50 (1989).
- C.-W. Leong and J.M. Ottino, Experiments on mixing due to chaotic advection in a cavity, *J. Fluid Mech.*, **209**, 463-499 (1989).
- J.G. Franjione, C.W. Leong, and J.M. Ottino, Symmetries within chaos: a route to effective mixing, *Phys. Fluids A*, **1**, 1772-1783 (1989).
- F. J. Muzzio and J.M. Ottino, Dynamics of a lamellar system with diffusion and reaction: Scaling analysis and global kinetics, *Phys. Rev. A*, **40**, 7182-7192 (1989).
- J.M. Ottino, Mixing, Chaotic advection, and turbulence, *Ann. Revs Fluid Mech.*, **22**, 207-54 (1990).
- C.-W. Leong and J.M. Ottino, Increase in regularity by polymer addition during chaotic mixing in two-dimensional flows, *Phys. Rev. Lett.*, **64**, 874-877 (1990).
- P.D. Swanson and J.M. Ottino, A comparative computational and experimental study of chaotic mixing of viscous fluids, *J. Fluid Mech.*, **213**, 227-249 (1990).
- T.J. Danielson and J.M. Ottino, Structural stability in two-dimensional model flows: Lagrangian and Eulerian turbulence, *Phys. Fluids A*, **2**, 2024-2035 (1990).
- F.J. Muzzio and J.M. Ottino. Diffusion and reaction in a lamellar system: Self-similarity with finite rates of reaction, *Phys. Rev. A*, **42**, 5873-5884 (1990).



- J.M. Ottino, Unity and Diversity in Mixing: Stretching, diffusion, breakup, and aggregation in chaotic flows, *Phys. Fluids A*, **5**, 1417-1430 (1991).
- F.J. Muzzio, P.D. Swanson, and J.M. Ottino, The statistics of stretching and stirring in chaotic flows, *Phys. Fluids A*, **5**, 822-834 (1991).
- T.J. Danielson, F.J. Muzzio, and J.M. Ottino, Aggregation and structure formation in chaotic and regular flows, *Phys. Rev. Lett.*, **66**, 3128-3131 (1991).
- K. Shariff, T.H. Pulliam, and J.M. Ottino, A dynamical systems analysis of kinematics in the time-periodic wake of a circular cylinder, *Lectures in Applied Mathematics*, **28**, 613-646 (1991).
- J.G. Franjione and J.M. Ottino, Stretching in duct flows, *Phys. Fluids A.*, **3**, 2819-2821 (1991); *erratum*, *Phys. Fluids*, **6**, 3501 (1991).
- M. Tjahjadi and J.M. Ottino, Stretching and breakup of droplets in chaotic flows, *J. Fluid Mech.*, **232**, 191-219 (1991).
- F.J. Muzzio, M. Tjahjadi, and J.M. Ottino, Self-similar drop size distributions produced by breakup in chaotic flows, *Phys. Rev. Lett.*, **67**, 54-57 (1991).
- H.A. Kusch and J.M. Ottino, Experiments on mixing in continuous chaotic flows, *J. Fluid Mech.*, **236**, 319-348 (1992).
- S.C. Jana and J.M. Ottino, Chaos-enhanced transport in cellular flows, *Proc. Roy. Soc. London A.*, **338**, 519-532 (1992). Also published in *Nonlinear Dynamics of Engineering Systems*, edited by J.M.T. Thompson and W. Schliehler, London: The Royal Society (1992).
- F.J. Muzzio, P.D. Swanson, and J.M. Ottino, Mixing distributions produced by multiplicative stretching in chaotic flows, *Int. J. Chaos and Bifurcations*, **2**, 37-50 (1992) (*cover article*).
- J.G. Franjione and J.M. Ottino, Symmetry concepts for the geometric analysis of mixing flows, *Phil. Trans. Roy. Soc. Lond.*, **338**, 301-323 (1992).
- F.J. Muzzio, C. Meneveau, P.D. Swanson, and J.M. Ottino, Scaling and multifractal properties of mixing in chaotic flows, *Phys. Fluids A*, **4**, 1439-1456 (1992).
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J.M. Ottino, S.C. Jana, and V.J. Chakravarthy, From Reynolds's stretching and folding to mixing studies using horseshoe maps, *Phys. Fluids A.*, **6**, 685-699 (1994).

M. Tjahjadi, H.A. Stone, and J.M. Ottino, Estimating interfacial tension via relaxation of drops shapes and filament breakup, *AIChE Journal*, **40**, 385-394 (1994).

G. Metcalfe and J.M. Ottino, Autocatalytic processes in chaotic flows, *Phys. Rev. Lett.*, **72**, 2875-2878 (1994); erratum, *Phys. Rev. Lett.*, **73**, 21 (1994).

S.C. Jana, G. Metcalfe, and J.M. Ottino, Experimental and computational studies of mixing in complex Stokes flows: The vortex mixing flow and multicellular cavity flows, *J. Fluid Mech.* **256**, 199-246 (1994).

S.C. Jana, M. Tjahjadi, and J.M. Ottino, Chaotic mixing of viscous fluids by periodic changes of geometry: The baffle-cavity system, *AIChE Journal*, **40**, 1769-1781 (1994).

T.C. Niederkorn and J.M. Ottino, Mixing of shear thinning fluids in time-periodic flows, *AIChE Journal*, **40**, 1782-1793 (1994).

J.M. Ottino, Mixing and chemical reactions: A tutorial, *Chem. Eng. Sci.* **49** (24A), 4005-4027 (1994).

T. Shinbrot and J.M. Ottino, Maps, PDE's and solitary waves, *Int. J. Bifur. Chaos*, **5**, 955-970 (1995).

G. Metcalfe, J.M. Ottino, C.R. Bina, Kinematical considerations for mantle mixing, *Geophys. Rev. Lett.*, **22**, 743-746 (1995).

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G. Metcalfe, T. Shinbrot, J.J. McCarthy, and J.M. Ottino, Avalanche mixing of granular materials, *Nature*, **374**, 39-41 (1995) (cover article).

V.J. Chakravarthy and J.M. Ottino, Mixing studies using horseshoes, *Int. J. Bifurcation and Chaos*, **5**, 519-530 (1995).

J. M. Ottino, A. Souvaliotis, and G. Metcalfe, Chaotic mixing processes: New problems and computational issues, *Chaos, Solitons, and Fractals*, **6**, 425-438 (1995).

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S. Hansen and J.M. Ottino, Aggregation and cluster size evolution in non-homogenous flows, *J. Colloid and Int. Sci.*, **179**, 89-103 (1996).

V.J. Chakravarthy and J.M. Ottino, Mixing of two viscous fluids in a rectangular cavity, *Chem. Eng. Sci.*, **51**, 3613-3622 (1996).

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20<sup>th</sup> International Symposium of Theoretical and Applied Mechanics (*plenary presentation*)  
2nd Experimental Chaos Conference, Washington, DC (*plenary presentation*)  
3M Center, Process Research and Technology, Division Engineering, St. Paul, Minnesota  
3M Technical Forum, 3M Technical Center, Corporate Research Laboratory, St. Paul, MN  
Abbott Laboratories  
Alcoa Technical Center, Pennsylvania  
Allied-Signal/UOP Research Center, Des Plaines, Illinois  
American Institute of Chemical Engineers  
American Physical Society  
Amherst College, Department of Physics  
ANTEC/SPE - New Technology Forum, San Francisco, California  
Argonne National Laboratory, DOE Nanotechnology symposium  
AT&T Bell Laboratories, Murray Hill, NJ  
Asia University, Taiwan  
BF Goodrich, Cleveland  
Boeing Leadership Center, Saint Louis  
Boston University, Center for Polymer Studies and Department of Physics, Boston, Massachusetts  
Brooklyn Polytechnic, Office Interdisciplinary Studies  
Brown University, Providence, Rhode Island, Division of Engineering  
California Institute of Technology, Pasadena, California, Department of Chemical Engineering  
California Institute of Technology, Pasadena, California, Fluid Mechanics Seminars  
California Institute of Technology, Pasadena, California, Graduate Aeronautic Laboratories  
Carnegie-Mellon University, School of Chemical Engineering  
Case Western Reserve University, Department of Macromolecular Science  
Celanese Research Co., Summit, New Jersey  
CETAD, Universidad Nacional de La Plata, La Plata, Argentina  
Chaos '89, sponsored by the American Physical Society, University of Rhode Island  
CIDCA, Universidad Nacional de La Plata, La Plata, Argentina  
College of Engineering Centennial Speaker, University of Maryland, College Park, Maryland  
Columbia University, Chemical Engineering  
Colorado State University, Fort Collins, Department of Agricultural and Chemical Engineering

Cornell University, Center for Applied Mathematics/Department of Theoretical and Applied Mechanics  
 University of California, Berkeley, Applied Mechanics Division of A.S.M.E. and Society for  
 Engineering Science  
 Cornell University, School of Chemical Engineering  
 Council for Chemical Research, St. Louis  
 Department of Geological Sciences, Northwestern University  
 Department of Physics, University of Massachusetts, Amherst, Massachusetts  
 Dow Chemical, Central Research Laboratory, Midland, Michigan  
 Dow Chemical, Central Research, Midland, MI  
 DSM Research, Geleen, The Netherlands (series of five lectures)  
 Duke University, Center for Nonlinear and Complex Systems  
 Dutch Foundation for Chemical Research, Eindhoven, The Netherlands  
 E.I. du Pont de Nemours & Co, Experimental Station, Wilmington, DE  
 E.I. du Pont, Kingston, North Carolina  
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 University of Minnesota, Chemical Engineering and Materials Science, Minneapolis, Minnesota  
 Eastman Kodak Research Laboratories, Rochester, New York  
 École Polytechnique, Université de Montréal  
 Environmental Protection Agency, Cincinnati  
 EPRI Workshop on Application of Chaos, San Francisco, California  
 Florida Atlantic University (Sigma Xi Lecture)  
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 Schenectady, New York  
 General Electric Company, Research and Development Center, Schenectady, NY  
 Georgia Institute of Technology, Department of Chemical Engineering  
 Georgia Institute of Technology, School of Physics  
 Google, Mountain View  
 Harvard University, Division of Applied Sciences and Engineering  
 Hong Kong University  
 Illinois Institute of Technology, Department of Chemical Engineering  
 Illinois Institute of Technology, Institute of Fine Particle Research  
 Indian Institute of Technology, Bombay  
 INTEC, Santa Fe, Argentina (series of seven two-hour lectures sponsored by the Inter American Bank)  
 INTEMA, Universidad de Mar del Plata, Mar del Plata, Argentina  
 Johns Hopkins University, Chemical Engineering Department  
 KAIST, Korea  
 Lacey Lectures, California Institute of Technology, Pasadena, California  
 Levich Institute, City College, University of New York, New York, New York  
 Lehigh University, Bethlehem, Pennsylvania.  
 Los Alamos National Laboratories, Physics-Theory Seminars  
 Louisiana State University, Department of Chemical Engineering,  
 Massachusetts Institute of Technology, Department of Chemical Engineering, Cambridge, Massachusetts  
 Xerox Research Centre of Canada, Mississauga, Ontario, Canada  
 Merck and Co., West Point, Pennsylvania  
 Merck Sharp & Dohme Lectures, Department of Chemical Engineering, University of Puerto Rico,  
 Mayagüez, Puerto Rico  
 Michigan State University/University of Michigan, combined seminar, Departments of Chemical  
 Engineering  
 Mobil Chemical Company, Edison Research Center, New Jersey  
 Nanyang Technical University, Singapore  
 National Bureau of Standards, Chemical Engineering and Metrology Division, Gaithersburg, Maryland  
 National Bureau of Standards, Fluid Mechanics Division, Gaithersburg, Maryland  
 National Bureau of Standards, Polymer Science and Standards Group, Gaithersburg  
 NATO Workshop in Mixing, Cargèse, Corsica, France  
 North Carolina State University, Raleigh, Department of Chemical Engineering,  
 Northwestern University, Department of Mathematics



Oak Ridge Sigma Xi Chapter (Sigma Xi Lecture)  
 Oak Ridge, AIChE Section  
 Ohio State University, Chemical Engineering  
 Oxford, St. Catherine's College  
 Penn State University, The Robb Lecture in Chemical Engineering Science, Department of Chemical Engineering and Materials Science  
 PLAPIQUI, Universidad Nacional del Sur, Bahia Blanca, Argentina, sponsored by the Interamerican Development Bank  
 Princeton School of Engineering and Applied Sciences  
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 Princeton Institute for the Science and Technology of Materials/PRISM and Princeton Center for Complex Materials/PCCM  
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 Raychem Corporation, Menlo Park, California  
 Rensselaer Polytechnic Institute, Department of Chemical Engineering  
 Rohm & Haas Company, Research Laboratories, Bristol, Pennsylvania  
 Royal Institution, Danckwerts Memorial Lecture, London  
 Royal Danish Academy of Sciences and Letters  
 Rutgers State University, Department of Chemical & Biochemical Engineering  
 Shell Development Company, Westhollow Research Center, Houston, Texas  
 Sigma Xi Research Society Annual Meeting, University of Puerto Rico, Mayagüez, Puerto Rico  
 Sigma Xi Spring Lecture, Northwestern University  
 Stanford University, Paul Flory Symposium  
 Stanford University, Center for Turbulence Research  
 Stanford University, Department of Chemical Engineering  
 Stanford University, Department of Chemical Engineering, Stanford, California  
 Stanford University, Seminar in Fluid Mechanics  
 Stanford University, Stanford, Summer Course, Center for Turbulence Research, Department of Mechanical Engineering  
 State University of New York at Buffalo, Chemical Engineering  
 Symposium on Contemporary Applications of Mathematics, The Five College Applied Mathematics Program, Mount Holyoke College, South Hadley, Massachusetts  
 Syracuse University, Department of Chemical Engineering  
 Tennessee Eastman, Kingsport, Tennessee  
 Terex, Westport, Connecticut  
 Texas A&M University, College Station, Department of Chemical Engineering  
 The Johns Hopkins University, Chemical Engineering  
 The Pennsylvania State University, Department of Chemical Engineering  
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 Unilever Research, Port Sunlight, UK  
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 University of Akron, Department of Chemical Engineering  
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 University of Arizona, Chemical Engineering  
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 University of Cambridge, Applied Mathematics and Theoretical Physics  
 University of Cambridge, Chemical Engineering  
 University of Chicago (James Frank Institute)  
 University of Cincinnati, Department of Chemical Engineering  
 University of Colorado (Boulder), Chemical Engineering  
 University of Delaware, Department of Chemical Engineering  
 University of Florida  
 University of Hawaii, Department of Oceanography, School of Earth Science and Oceanography  
     Northwestern University, Department of Physics  
 University of Houston, Department of Chemical Engineering,  
 University of Illinois at Chicago, Chemical Engineering  
 University of Illinois at Urbana-Champaign, Chemical Engineering  
 University of Illinois at Urbana-Champaign, Workshop on Scientific Issues in Multiphase Flows  
 University of Illinois, Chemical Engineering, Chicago  
 University of Illinois, Chicago  
 University of Massachusetts, Amherst, Condensed Matter Seminars, Department of Physics and Astronomy  
 University of Massachusetts, Amherst, Department of Food Engineering  
 University of Massachusetts, Amherst, Department of Physics  
 University of Massachusetts, Amherst, Department of Polymer Science and Engineering  
 University of Massachusetts, Amherst, Massachusetts, Applied Mathematics Seminars, Department of  
     Mathematics  
 University of Massachusetts, Amherst, Massachusetts, Department of Polymer Science and Engineering  
 University of Michigan, Department of Chemical Engineering,  
 University of Michigan, Department of Mechanical Engineering and Applied Mechanics  
 University of Minnesota, Chemical Engineering and Materials Sciences  
 University of Minnesota, Department of Aerospace and Mechanics (Mechanics Seminars), Minneapolis,  
     Minnesota  
 University of Minnesota, Institute for Mathematics and its Applications  
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 University of Notre Dame, Department of Chemical Engineering  
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 University of Pennsylvania, Department of Chemical Engineering  
 University of Pittsburgh, Chemical and Petroleum Engineering  
 University of South Carolina, "Images in Nanotechnology" Conferences  
 University of South Carolina, Chemical Engineering  
 University of Southern California, Department of Chemical Engineering  
 University of Tennessee, Department of Chemical Engineering  
 University of Texas, Austin, Department of Chemical Engineering  
 University of Texas, Austin, Nonlinear Dynamics  
 University of Vermont, Dean's Distinguished Lecture  
 University of Virginia, Chemical Engineering  
 University of Washington, Seattle, Department of Chemical Engineering  
 University of Wisconsin, Madison, Department of Chemical Engineering  
 Washington University, Department of Chemical Engineering  
 World Congress of Chemical Engineering (*plenary*), Glasgow, Scotland  
 XL National Congress of Physics; Monterrey, Mexico (*plenary talk*)  
 Yale University, Department of Mechanical Engineering

***Consulting***

3M (1994-2000), DSM, Netherlands (1992-1998), Rohm & Haas (1993), Gardner, Carton & Douglas (1994), B.F. Goodrich (1996-97), Unilever (1997-2008), Helene Curtis (1997), Intellicoat (1998), Dow Chemical (2000-2004), Merck (2000), Abbott (2001), Baxter (2002-3), Resodyn Corp. (2004-), SC Johnson (2004), Brookwood Pharmaceuticals (2006), Swagelok (2008), AkzoNobel (2010-2014).

***Funding and Advising***

Supervised over 67 Ph.D. students – from chemical engineering, mechanical engineering, polymer science, physics, and applied mathematics – currently working in industry and academia (of these, over 30 have been singly advised by JMO). Federal funding sources have included NSF, DOE, AFOSR, and the U.S. Army. Industrial sources have included ALCOA, 3M, Exxon, Xerox, Dow Chemical, Owens Corning, Union Carbide, Rohm & Haas, du Pont, and others. Other sources have included The Petroleum Research Fund and the Dreyfus Foundation. Current PI in one NSF grant.