

## **SANKARAN SUNDARESAN**

Norman John Sollenberger Professor of Engineering  
Department of Chemical and Biological Engineering  
Princeton University, Princeton, New Jersey 08544 USA  
(609) 258-4583 (tel); (609) 258-0211 (fax); sundar@princeton.edu

### **Education Record**

B. Tech., Chemical Engineering, Indian Institute of Technology, Madras, 1971-76.  
M.S., Chemical Engineering, University of Houston, Houston, Texas, 1976-78.  
Ph.D., Chemical Engineering, University of Houston, Houston, Texas, 1978-80.

### **Employment**

1980 – 1987 Assistant Professor of Chemical Engineering, Princeton University,  
Princeton, New Jersey

1987 – 1992 Associate Professor of Chemical Engineering, Princeton University,  
Princeton, New Jersey

1988 – 1989 Visiting Associate Professor, Materials Science and Engineering,  
University of Washington, Seattle, Washington.

1989 – 1995 Departmental Representative, Chemical Engineering, Princeton University

Summer 1990 Visiting Scientist, Mobil Research & Dev. Corporation, Paulsboro, NJ

1992 – Professor of Chemical Engineering, Princeton University

1997 – 2003 Associate Dean for Academic Affairs, School of Engineering & Applied  
Sciences, Princeton University

March 2007 – August 2007 Moore Distinguished Scholar, California Institute of Technology

2009 – 2013 JM Burgers Visiting Professor, TU Delft, The Netherlands.

2014 – Guest Professor, TU Hamburg-Harburg, Hamburg, Germany

2015 – Norman John Sollenberger Professor of Engineering, Princeton University

Spring 2017 Acting Associate Director for Research, Andlinger Center for Energy and the  
Environment, Princeton University

## Courses Taught at Princeton

Sophomore Level:	Chemical Engineering Analysis Introduction to Chemical Engineering Principles
Junior Level:	Chemical Engineering Laboratory Fluid Mechanics Mass, Momentum and Energy Transport Energy-Water Nexus
Senior Level:	Chemical Reaction Engineering Chemical Process Control Environmental Technology: Pollution Prevention & Treatment
Graduate Level:	Fluid Mechanics Advanced Heat and Mass Transfer Topics in Transport Phenomena Chemical Reaction Engineering Mathematical Methods in Chemical Engineering Advanced Process Control Applied Mathematics Introduction to Ceramics Mechanics of Granular Materials & Two-phase Flows

## Current areas of Research

Multiphase Hydrodynamics, Flow of particulate systems, Chemical Reaction Engineering

## Recent Major External Service

Associate Editor, The Amer. Inst. Chem. Engrs. Journal	(2002 – 2011)
Associate Editor, Chemical Engineering Journal	(1995 – 1999)
Editorial Board: Powder Technology,	(2002 – )
Ind. Eng. Chem. Research	(2003 – 2005)
International Journal of Multiphase Flow	(2004 – )
Multiphase Science & Technology	(2008 – )
Vice-chair, AIChE Catalysis & Reaction Eng. Division	(1999 – 2000)
Chair, AIChE Catalysis & Reaction Eng. Division	(2001)
Chair, Engineering Foundation Conference: CFD in CRE 7	(2000)
Chair, Princeton University Conference “Engineers as Leaders”	(2001)
Board Member – International Symposium on Chemical Reaction Engineering; President: 2015-16)	(2005 – 2018)
Chair – 21 <sup>st</sup> International Symposium on Chemical Reaction Engineering, Philadelphia	(2010)
AIChE International Committee (Chair: 2013-2014)	(2010 –2014)
Executive Committee – Carbon Capture Simulation Initiative, US Department of Energy	(2011 – 2016)

## Awards & Honors

Rheinstein Award for Outstanding Young Faculty, Princeton University, 1982.  
Richard H. Wilhelm Award in Chemical Reaction Engineering, American Institute of Chemical Engineers, 1999.  
Distinguished Alumnus Award, Indian Institute of Technology-Madras, Chennai, India, 2000.  
Princeton University – Engineering Council Awards for Excellence in Teaching, 2005, 2008, 2012.  
Princeton University – School of Engineering & Applied Science Distinguished Teacher Award, 2005.  
American Institute of Chemical Engineers – 2005 Thomas A. Baron Award in Fluid-Particle Systems. Awarded in November 2005.  
Princeton University – President’s Award for Distinguished Teaching, 2006.  
California Institute of Technology – Moore Distinguished Scholar, 2007.  
Distinguished DB Robinson Lecturer – University of Alberta, 2007.  
Fellow, American Institute of Chemical Engineers, 2008.  
JM Burgers Lecture, Eindhoven, The Netherlands, 2009.  
JM Burgers Visiting Professor of Fluid Mechanics at TU Delft, The Netherlands, 2009 – 2013.  
Neal R Amundson Lecture, The University of Houston, 2010.  
Plenary Lecture – Tenth International Conference on Circulating Fluidized Beds, Sunriver, OR, 2011.  
Plenary Lecture – 22<sup>nd</sup> International Symposium on Chemical Reaction Engineering, Maasricht, The Netherlands, 2012.  
Plenary Lecture – Fluidization XIV, Noordwijkerhout, The Netherlands, 2013.  
Alkyl Amine’s Padma Bhushan Dr. B. D. Tilak Chemcon Distinguished Lecture, Chemcon 2013, Mumbai, India, 2013.  
RV Jones Distinguished Lecture, University of Aberdeen, Scotland, 2014.  
Alexander von Humboldt Research Award, 2014.  
Permanent Guest Professor, TU Hamburg-Harburg, Hamburg, Germany (2014 – )  
Norman John Sollenberger Professor of Engineering, Princeton University (from 2015)  
Princeton University – Graduate mentoring Award, 2016.

## Publications

1. S. Sundaresan and N. R. Amundson, "Studies in Char Gasification: I. A Lumped Model," *Chem. Eng. Sci.*, **34**, 345 (1979).
2. S. Sundaresan and N. R. Amundson, "Studies in Char Gasification: II. The Davidson-Harrison Two Phase Model of Fluidization," *Chem. Eng. Sci.*, **34**, 355 (1979).
3. S. Sundaresan and N. R. Amundson, "Studies in Char Gasification: III. The Combustion Zone," *Chem. Eng. Sci.*, **34**, 359 (1979).
4. S. Sundaresan and N. R. Amundson, "Studies in Char Gasification: IV. Multi-Stage Char Gasifier," *Chem. Eng. Sci.*, **34**, 463 (1979).
5. S. Sundaresan and N. R. Amundson, "Studies in Char Gasification: V. Ash Recirculation Model," *Chem. Eng. Sci.*, **34**, 469 (1979).
6. M. J. Hinduja, S. Sundaresan and R. Jackson, "A Crossflow Model for Dispersion in Packed Bed Reactors," *AIChE J.*, **26**, 274 (1980).
7. S. Sundaresan, N. R. Amundson and R. Aris, "Observations on Fixed-Bed Dispersion Models: The Role of Interstitial Fluid." *AIChE J.*, **26**, 529 (1980).
8. S. Sundaresan and N. R. Amundson, "Diffusion and Reaction in a Stagnant Boundary Layer about a Carbon Particle: 5. Pseudo-Steady-State Structure and Parameter Sensitivity," *Ind. Eng. Chem. Fundam.*, **19**, 344 (1980).
9. S. Sundaresan and N. R. Amundson, "Diffusion and Reaction in a Stagnant Boundary Layer about a Carbon Particle: 6. Effect of Water Vapor on the Pseudo-Steady-State Structure," *Ind. Eng. Chem. Fundam.*, **19**, 351 (1980).
10. S. Sundaresan and N. R. Amundson, "Diffusion and Reaction in a Stagnant Boundary Layer About a Carbon Particle: Part 7: Transient Behavior and Effect of Water Vapor," *AIChE J.*, **27**, 679 (1981).
11. K. R. Kaza and S. Sundaresan, "CO Oxidation on Pt (III): The Effect of Interactions between Adsorbates and Adsorbate Mobility on Reaction Rate," in "Frontiers in Chemical Reaction Engineering", Vol. II, L. K. Doraiswamy and R. A. Mashelkar (Eds.), Wiley Eastern Ltd., pp. 323-335 (1984).
12. K. R. Kaza and S. Sundaresan, "Non-Random Distribution of Adsorbates on Catalytic Surfaces: The Role of Interactions between Adsorbates," *Chem. Eng. Commun.*, **32**, 333 (1985).
13. S. Sundaresan and K. R. Kaza, "Non-Random Distribution of Adsorbates on Catalytic Surfaces: The Role of Adsorbate Mobilities on Reaction Rates," *Chem. Eng. Commun.*, **35**, 1 (1985).
14. S. Sundaresan and K. R. Kaza, "The Effect of Limited Mobility of Adspecies on the Rates of Desorption and Reaction," *Surf. Sci.*, **160**, 103 (1985).
15. V. A. Burrows, S. Sundaresan, Y. J. Chabal and S. B. Christman, "Studies on Self-Sustained Reaction-Rate Oscillations: I. Real-Time Surface Infrared Measurements During Oscillatory Oxidation of Carbon Monoxide on Platinum," *Surf. Sci.*, **160**, 122 (1985).
16. J. S. Buchanan, J. Apostolakis and S. Sundaresan, "Pretreatment and Activation of a Vanadium Phosphate Catalyst for Butane Oxidation to Maleic Anhydride," *Appl. Catal.*, **19**, 65 (1985).
17. J. S. Buchanan and S. Sundaresan, "Optimal Distribution of Multifunctional Catalysts in a Packed Bed Reactor," *Chem. Eng. Commun.*, **40**, 25 (1986).

18. I. S. Metcalfe and S. Sundaresan, "Oxygen Storage in Automobile Exhaust Catalyst," *Chem. Eng. Sci.*, **41**, 1109 (1986).
19. S. Sundaresan and C. K. Hall, "Mathematical Modelling of Diffusion and Reaction in Blocked Zeolite Catalysts," *Chem. Eng. Sci.*, **41**, 1631 (1986).
20. G. Christensen, S. J. McGovern and S. Sundaresan, "Cocurrent Downflow of Air and Water in a Two-Dimensional Packed Column," *AIChE J.*, **32**, 1677 (1986).
21. J. S. Buchanan and S. Sundaresan, "Kinetics and Redox Properties of Vanadium Phosphate Catalysts for Butane Oxidation," *Appl. Catal.*, **26**, 211 (1986).
22. T. R. Reilly, S. Sundaresan and J. H. Highland, "Cleanup of PCB Contaminated Soils and Sludges by a Solvent Extraction Process: A Case Study," in "Studies of Environmental Science: Vol. 29, Chemistry for Protection of the Environment," L. Pawlowski, G. Alaerts, and W. J. Lacy (Eds.), Elsevier, pp. 125-139, 1986.
23. V. A. Burrows, S. Sundaresan, Y. J. Chabal and S. B. Christman, "Studies on Self-Sustained Reaction-Rate Oscillations: II. The Role of Carbon and Oxides in the Oscillatory Oxidation of Carbon Monoxide on Platinum," *Surf. Sci.*, **180**, 110 (1987).
24. N. A. Collins, S. Sundaresan and Y. J. Chabal, "Studies on Self-Sustained Reaction-Rate Oscillations: III. The Carbon Model," *Surf. Sci.*, **180**, 136 (1987).
25. S. Sundaresan, "Mathematical Modeling of Pulsing Flow in Large Trickle Beds," *AIChE J.*, **33**, 455 (1987).
26. E. M. Breckner, S. Sundaresan and J. B. Benziger, "Solid Electrolyte Potentiometry Study of Butene Oxidation over Vanadium Phosphate Catalysts," *Appl. Catal.*, **30**, 277 (1987).
27. V. A. Burrows, S. Sundaresan and Y. J. Chabal, "Real-Time Study of Self-sustained Oscillations in the CO Oxidation Rate on Pt," *J. Vac. Sci. Technol.*, **A5**, 801 (1987).
28. Y. J. Chabal, S. B. Christman, V. A. Burrows, N. A. Collins and S. Sundaresan, "Self-Sustained Kinetic Oscillations in the Catalytic CO Oxidation on Platinum," "Springer Series in Surface Science: Vol. 8, Kinetics of Interface Reactions," p. 285-295 (1987).
29. J. S. Buchanan and S. Sundaresan, "Optimal Catalyst Distribution and Dilution in Nonisothermal Packed Bed Reactors," *Chem. Eng. Comm.*, **52**, 33 (1987).
30. S. Sundaresan, J. K. Wong and R. Jackson, "Limitations of the Equilibrium Theory of Countercurrent Devices," *AIChE J.*, **33**, 1466 (1987).
31. E. W. Arnold, III and S. Sundaresan, "The Role of Lattice Oxygen in the Dynamic Behavior of Oxide Catalysts," *Chem. Eng. Comm.*, **58**, 213 (1987).
32. I. S. Metcalfe and S. Sundaresan, "Oxygen Transfer between Metals and Oxygen-Ion Conducting Supports," *AIChE J.*, **34**, 195 (1988).
33. E. W. Arnold, III and S. Sundaresan, "Effect of Water Vapor on the Activity and Selectivity Characteristics of Vanadium Phosphate Catalysts Towards Butane Oxidation," *Appl. Catal.*, **41**, 225 (1988).
34. I. S. Metcalfe and S. Sundaresan, "Oxygen Transfer between Rhodium and an Oxygen-Ion Conducting Support," *AIChE J.*, **34**, 1048 (1988).
35. N. A. Collins, P. G. Debenedetti and S. Sundaresan, "Disproportionation of Toluene over ZSM-5 under Near-Critical Conditions," *AIChE J.*, **34**, 1211 (1988).
36. K. Grosser, R. G. Carbonell and S. Sundaresan, "Onset of Pulsing in Two-Phase Cocurrent Downflow through a Packed Bed," *AIChE J.*, **34**, 1850 (1988).
37. E. W. Arnold, III and S. Sundaresan, "Dynamics of Packed-Bed Reactors Loaded with Oxide Catalysts," *AIChE J.*, **35**, 746 (1989).

38. D. C. Dankworth and S. Sundaresan, "A Macroscopic Model for Countercurrent Gas-Liquid Flow in Packed Columns," *AIChE J.*, **35**, 1282 (1989).
39. S. Sundaresan and I. A. Aksay, "Sintering with Rigid Inclusions: Pair Interactions," *J. Amer. Ceram. Soc.*, **73**, 54 (1990).
40. D. C. Dankworth, I. G. Kevrekidis and S. Sundaresan, "Dynamics of Pulsing Flow in Trickle Beds," *AIChE J.*, **36**, 605 (1990).
41. D. C. Dankworth, I. G. Kevrekidis and S. Sundaresan, "Time Dependent Hydrodynamics in Multiphase Reactors," *Chem. Eng. Sci.*, **45**, 2239 (1990).
42. D. A. Faux, C. K. Hall and S. Sundaresan, "Diffusion in Zeolites: Effect of Directional Bias," *Chem. Eng. Sci.*, **46**, 2359 (1991).
43. J. A. Pita and S. Sundaresan, "Gas-Solid Flow in Vertical Tubes," *AIChE J.*, **37**, 1009 (1991).
44. M. J. Szady and S. Sundaresan, "Effect of Boundaries on Trickle-Bed Hydrodynamics," *AIChE J.*, **37**, 1237 (1991).
45. S. Sundaresan and I. A. Aksay, "Mullitization of Diphasic Aluminosilicate Gels," *J. Amer. Ceram. Soc.*, **74**, 2388 (1991).
46. D. C. Dankworth and S. Sundaresan, "Time-Dependent Vertical Gas-Liquid Flow in Packed Beds," *Chem. Eng. Sci.*, **47**, 337 (1992).
47. D. C. Dankworth, S. Sundaresan and I. G. Kevrekidis, "Infinite-Wavelength Analysis for Two-Phase Flow: A Three-Parameter Computer-Assisted Study of Global Bifurcations," *Physica D*, **55**, 197 (1992).
48. D. C. Dankworth and S. Sundaresan, "Stability of Periodic Travelling Waves in Trickle Beds," *Chem. Eng. Sci.*, **47**, 3257 (1992).
49. S. Sundaresan, "Effect of Ambient Environment and Pressure on the Formation of  $\text{YBa}_2\text{Cu}_3\text{O}_{6+x}$  from  $\text{Y}_2\text{O}_3$ ,  $\text{BaCO}_3$  and  $\text{CuO}$ ," *AIChE Symp. Ser. 287*, **88**, 82 (1992).
50. J. A. Pita and S. Sundaresan, "Developing Flow of a Gas-Particle Mixture in a Vertical Riser," *AIChE J.*, **39**, 541 (1993).
51. R. Ocone, S. Sundaresan and R. Jackson, "Gas-Particle Flow in a Duct of Arbitrary Inclination with Particle-Particle Interactions," *AIChE J.*, **39**, 1261 (1993).
52. S. Dasgupta, R. Jackson and S. Sundaresan, "Turbulent Gas-Particle Flow in Vertical Risers," *AIChE J.*, **40**, 215 (1994).
53. S. Dasgupta, R. Jackson and S. Sundaresan, "Turbulent Gas-Particle Flow in CFB Risers," Proceedings of The Fourth International Conference on Circulating Fluid Beds, 367-372 (1994).
54. C. Gerardin, S. Sundaresan, J. B. Benziger and A. Navrotsky, "Structural Investigation and Energetics of Mullite Formation from Sol-Gel Precursors," *Chem. Mater.*, **6**, 160 (1994).
55. S. Sundaresan, "Liquid Distribution in Trickle Bed Reactors," *Energy & Fuels*, **8**, 531 (1994).
56. V. V. Guliants, J. B. Benziger and S. Sundaresan, "Intercalation of Aliphatic Amines into the Layered Structure of Vanadyl (IV) Hydrogen Phosphate Hemihydrate ( $\text{VOHPO}_4 \cdot 0.5\text{H}_2\text{O}$ )," *Chem. Mater.*, **6**, 353 (1994).
57. V. V. Guliants, J. B. Benziger and S. Sundaresan, "Synthesis and Characterization of Vanadyl Phosphite,  $\text{V}^{\text{IV}}\text{OHP}^{\text{III}}\text{O}_3 \cdot 1.5\text{H}_2\text{O}$ ," *Chem. Mater.*, **7**, 1485 (1995).

58. V. V. Guliants, J. B. Benziger, S. Sundaresan, I. E. Wachs and J.-M. Jehng, "Vanadyl (IV) Phosphonates,  $\text{VO}_n\text{H}_{2n+1}\text{PO}_3 \cdot x\text{H}_2\text{O}$  ( $n=0-4$ ,  $x=1$  or  $1.5$ ) as Precursors of Vanadyl (IV) Pyrophosphate,  $(\text{VO})_2\text{P}_2\text{O}_7$ ," *Chem. Mater.*, **7**, 1493 (1995).
59. V. V. Guliants, J. B. Benziger, S. Sundaresan, N. Yao and I. E. Wachs, "Evolution of the Active Surface of the Vanadyl Pyrophosphate Catalysts," *Catal. Lett.*, **32**, 379 (1995).
60. K. Anderson, S. Sundaresan and R. Jackson, "Instabilities and the Formation of Bubbles in Fluidized Beds," *J. Fluid Mech.*, **303**, 327 (1995).
61. V. V. Guliants, J. B. Benziger and S. Sundaresan, "New Layered Vanadyl (IV) Phosphite as a Precursor to Vanadyl Pyrophosphate Catalysts for Partial Oxidation of *n*-Butane to Maleic Anhydride," *J. Catal.*, **156**, 298 (1995).
62. R. Muralidhar, G. R. Jersey, F. J. Krambeck and S. Sundaresan, "A Two-Phase Release Model for Quantifying Risk Reduction for Modified HF Alkylation Catalysts," *J. Hazard. Mater.*, **44**, 141 (1995).
63. R. Muralidhar, G. R. Jersey, F. J. Krambeck and S. Sundaresan, "A Two-Phase Model for Subcooled and Superheated Liquid Jets," AICHE Symposium Series: Proceedings of the International Conference & Workshop on Modelling and Mitigating the Consequences of Accidental Releases of Hazardous Materials, September 26-29, 1995, New Orleans, 189-224 (1995).
64. C.-H. Wang, R. Jackson and S. Sundaresan, "Stability of Bounded Rapid Shear Flows of a Granular Material," *J. Fluid Mech.*, **308**, 31 (1996).
65. B. J. Glasser, I. G. Kevrekidis and S. Sundaresan, "One- and Two-Dimensional Travelling Wave Solutions in Gas-Fluidized Beds," *J. Fluid Mech.*, **306**, 183 (1996).
66. V. V. Guliants, J. B. Benziger, S. Sundaresan, I. E. Wachs, J. -M. Jehng and J. E. Roberts, "The Effect of Phase Composition of Model VPO Catalysts for Partial Oxidation of *n*-Butane," *Catal. Today*, **28**, 275 (1996).
67. V. V. Guliants, J. B. Benziger and S. Sundaresan, "The Oxidation of  $\text{C}_4$  Molecules on Vanadyl Pyrophosphate Catalysts", in "11<sup>th</sup> International Congress on Catalysis – 40<sup>th</sup> Anniversary Studies in Surface Science and Catalysis," Vol. 101, J. W. Hightower, W. N. Delgass, E. Iglesia and A. T. Bell (Eds.), Elsevier Science B.V., pp. 991-1000, (1996).
68. M. Simpson, J. Wei and S. Sundaresan, "Kinetics of Zeolitic Solid Acid-Catalyzed Alkylation of Isobutane with 2-Butene," *ACS Symp. Ser.*, **626**, 105 (1996).
69. M. F. Simpson, J. Wei and S. Sundaresan, "Kinetic Analysis of Isobutane/Butene Alkylation over Ultrastable H-Y Zeolites," *Ind. Eng. Chem. Res.*, **35**, 3861 (1996).
70. M. F. Göz, B. J. Glasser, I. G. Kevrekidis and S. Sundaresan, "Traveling Waves in Multi-Phase Flows," *Adv. Fluid Mech.*, **9**, 307 (1996).
71. B. J. Glasser, I. G. Kevrekidis and S. Sundaresan, "Fully Developed Travelling Wave Solutions and Bubble Formation in Fluidized Beds," *J. Fluid Mech.*, **334**, 157 (1997).
72. J. B. Benziger, V. Guliants and S. Sundaresan, "New Precursors to Vanadium Phosphorus Oxide Catalysts," *Catal. Today*, **33**, 49 (1997).
73. C.-H. Wang, R. Jackson and S. Sundaresan, "Instabilities of Fully Developed Rapid Flow of a Granular Material in a Channel," *J. Fluid Mech.*, **342**, 179 (1997).
74. S. Dasgupta, R. Jackson and S. Sundaresan, "Developing Flow of Gas-Particle Mixtures in Vertical Ducts," *Ind. Eng. Chem. Res.*, **36**, 3375 (1997).
75. I. E. Wachs, J.-M. Jehng, G. Deo, B. M. Weckhuysen, V. V. Guliants, J. B. Benziger and S. Sundaresan, "Fundamental Studies of Butane Oxidation over Model-Supported Vanadium Oxide Catalysts: Molecular Structure-Reactivity Relationships," *J. Catal.*, **170**, 75 (1997).

76. J. M. McHale, K. Yürekli, D. M. Dabbs, A. Navrotsky, S. Sundaresan and I. A. Aksay, "Metastability of Spinel-Type Solid Solutions in the SiO<sub>2</sub>-Al<sub>2</sub>O<sub>3</sub> System," *Chem. Mater.*, **9**, 3096 (1997).
77. M. F. Simpson, J. Wei and S. Sundaresan, "Rebuttal to the Comments of Lyle F. Albright on 'Kinetic Analysis of Isobutane/Butene Alkylations over Ultrastable H-Y Zeolite,'" *Ind. Eng. Chem. Res.*, **36**, 2517 (1997).
78. M. F. Göz and S. Sundaresan, "The Growth, Saturation, and Scaling Behaviour of One- and Two-Dimensional Disturbances in Fluidized Beds," *J. Fluid Mech.*, **362**, 83 (1998).
79. S. Dasgupta, R. Jackson, and S. Sundaresan, "Gas-Particle Flow in Vertical Pipes with High Mass Loading of Particles," *Powder Tech.*, **96**, 6 (1998).
80. A. Srivastava, K. Agrawal, S. Sundaresan, S. B. Reddy Karri and T. M. Knowlton, "Dynamics of Gas-Particle Flow in Circulating Fluidized Beds," *Powder Tech.*, **100**, 173 (1998).
81. B. J. Glasser, S. Sundaresan and I. G. Kevrekidis, "From Bubbles to Clusters in Fluidized Beds," *Phys. Rev. Lett.*, **81**, 1849 (1998).
82. K. Sankaranarayanan, X. Shan, I. G. Kevrekidis and S. Sundaresan, "Bubble Flow Simulations with the Lattice Boltzmann Method," *Chem. Eng. Sci.*, **54**, 4817 (1999).
83. P. R. Nott, M. Alam, K. Agrawal, R. Jackson and S. Sundaresan, "The Effect of Boundaries on the Plane Couette Flow of Granular Materials: A Bifurcation Analysis," *J. Fluid Mech.*, **397**, 203 (1999).
84. V. V. Gulians, J. B. Benziger, S. Sundaresan, I. E. Wachs and A. M. Hirt, "Effect of Promoters for *n*-Butane Oxidation to Maleic Anhydride over Vanadium-Phosphorus-Oxide Catalysts: Comparison with Supported Vanadia Catalysts," *Catal. Lett.*, **62**, 87 (1999).
85. S. Sundaresan, "Perspective: Modeling the Hydrodynamics of Multiphase Flow Reactors: Current Status and Challenges," *AIChE J.*, **46**, 1102 (2000).
86. K. Agrawal, P. N. Loezos, M. Syamlal and S. Sundaresan, "The Role of Meso-Scale Structures in Rapid Gas-Solid Flows," *J. Fluid Mech.*, **445**, 151 (2001).
87. S. M. Rao, K. Zhu, C.-H. Wang and S. Sundaresan, "Electrical Capacitance Tomography Measurements on the Pneumatic Conveying of Solids," *Ind. Eng. Chem. Res.*, **40**, 4216 (2001).
88. S. Sundaresan, "Some Outstanding Questions in Handling of Cohesionless Particles", *Powder Tech.*, **115**, 2 (2001).
89. K. Sankaranarayanan, X. Shan, I. G. Kevrekidis and S. Sundaresan, "Analysis of Drag and Virtual Mass Forces in Bubbly Suspensions Using an Implicit Formulation of the Lattice Boltzmann Method," *J. Fluid Mech.*, **452**, 61 (2002).
90. A. Srivastava and S. Sundaresan, "Role of Wall Friction in Fluidization and Standpipe Flow," *Powder Tech.*, **124**, 45 (2002).
91. M. F. Al-Adel, D. A. Saville and S. Sundaresan, "The Effect of Static Electrification on Gas-Solid Flows in Vertical Risers," *Ind. Eng. Chem. Res.*, **41**, 6224 (2002).
92. P. Loezos and S. Sundaresan, "The Role of Meso-Scale Structures on Dispersion in Gas-Particle Flows," in *Circulating Fluidized Beds VII*, Eds. J. R. Grace, J. Zhu, and H. I. de Lasa, Can. Society of Chemical Engineering, Ottawa, pp. 427-434, (2002).
93. P. N. Loezos, P. Costamagna and S. Sundaresan, "The Role of Contact Stresses and Wall Friction on Fluidization," *Chem. Eng. Sci.*, **57**, 5123 (2002).



94. K. Sankaranarayanan and S. Sundaresan, "Lift Force in Bubbly Suspensions," *Chem. Eng. Sci.*, **57**, 3521 (2002).
95. S. Sundaresan, "Instabilities in Fluidized Beds," *Annu. Rev. Fluid Mech.*, **35**, 63 (2003).
96. A. Srivastava and S. Sundaresan, "Analysis of a Frictional-Kinetic Model for Gas-Particle Flow," *Powder Tech.*, **129**, 72 (2003).
97. K. Zhu, S. M. Rao, C.-H. Wang, and S. Sundaresan, "Electrical Capacitance Tomography Measurements on Vertical and Inclined Pneumatic Conveying of Granular Solids," *Chem. Eng. Sci.*, **58**, 4225 (2003).
98. K. Sankaranarayanan, I. G. Kevrekidis, S. Sundaresan, J. Lu and G. Tryggvason, "A Comparative Study of Lattice Boltzmann and Front-Tracking Finite-Difference Methods for Bubble Simulations," *Int. J. Multiphase Flow*, **29**, 109 (2003).
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100. S. Sundaresan, J. Eaton, D. L. Koch and J. M. Ottino, "Appendix 2: Report of Study Group on Disperse Flow," *Int. J. Multiphase Flow*, **29**, 1069 (2003).
101. C. Theodoropoulos, K. Sankaranarayanan, S. Sundaresan and I. G. Kevrekidis, "Coarse Bifurcation Studies of Bubble Flow Lattice Boltzmann Simulations," *Chem. Eng. Sci.*, **59**, 2357 (2004).
102. C. H. Nam, R. Pfeffer, R. N. Dave and S. Sundaresan, "Aerated Vibrofluidization of Silica Nanoparticles," *AIChE J.*, **50**, 1776 (2004).
103. B. K. Muite, S. F. Quinn, S. Sundaresan and K. K. Rao, "Silo Music and Silo Quake: Granular Flow-Induced Vibration," *Powder Tech.*, **145**, 190 (2004).
104. A. T. Andrews, P. N. Loezos and S. Sundaresan, "Coarse-Grid Simulation of Gas-Particle Flows in Vertical Risers," *Ind. Eng. Chem. Res.*, **44**, 6022 – 6037 (2005).
105. A. Ten Cate and S. Sundaresan, "Analysis of the Flow in Inhomogeneous Particle Beds Using the Spatially Averaged Two-Fluid Equations," *Int. J. Multiphase Flow*, **32**, 106 -131 (2006).
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### **Book Chapters**

- 1) A. Prosperetti, S. Sundaresan, S. Pannala and D. Z. Zhang, "Chapter 10: Segregated methods for two-fluid models," in *Computational Methods for Multiphase Flow*, edited by A. Prosperetti & G. Tryggvason (Cambridge University Press), 2006.

### **Patents**

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