Avelino Eduardo Sáez
Curriculum Vitae

Current Position:	Distinguished Professor Department of Chemical and Environmental Engineering, and Mel and Enid Zuckerman College of Public Health University of Arizona, Tucson, AZ 85721 (at the University of Arizona since 1998)
E-mail:	esaez@email.arizona.edu
Phone:	(520) 6215369

Academics

1. Universidad Simón Bolívar, Caracas, Venezuela, B.Sc. in Chemical Engineer), July 1978.
2. University of California, Davis, Degree conferred: M.Sc. in Chemical Engineering, September 1981.
3. University of California, Davis, Degree conferred: Ph.D. in Chemical Engineering, June 1984.

Other Professional Experience

1. Departamento de Termodinámica y Fenómenos de Transferencia, Universidad Simón Bolívar, Caracas, Venezuela, Instructor: September 1978-March 1980.
2. Department of Chemical Engineering, North Carolina State University, Raleigh, Visiting Research Associate: July-December 1984.
3. Department of Physics, University of Bristol, Bristol, U.K., Visiting Research Associate with a Marie Curie fellowship granted by the European Community: January-December 1992.
4. Departamento de Termodinámica y Fenómenos de Transferencia, Universidad Simón Bolívar, Caracas, Assistant, Associate and Full Professor: 1985-1995.
5. Department of Chemical Engineering, North Carolina State University, Raleigh, Visiting Scholar and Research Associate Professor: October 1995-July 1998.
6. Visiting Scientist, Pacific Northwest National Laboratories, Richland, Washington, October 2005-March 2006.

Courses Taught

Undergraduate Level

At Universidad Simón Bolívar: Thermodynamics I and II, Transport Phenomena I (Fluid Mechanics), Heat Transfer I, Chemical Engineering Problems, Separation Processes II, Chemical Reactor Analysis.

At North Carolina State University: Transport Processes II.

At The University of Arizona: Chemical Engineering Mass Transfer, Heat Transfer and Fluid Flow, Transport Phenomena, Unit Operations Laboratory, Elements of Chemical Engineering II, Rheology: Principles and Applications, Chemical Engineering Laboratory, Chemical Engineering Modeling, Environment and Human Rights.

Graduate Level

At Universidad Simón Bolívar: Fluid Mechanics, Advanced Chemical Engineering Analysis, Approximate Methods in Engineering, Transport Phenomena in Porous Media, Transport Phenomena in Continua, Rheology of Polymer Solutions.

At North Carolina State University: Transport Phenomena I.

At The University of Arizona: Advanced Chemical Engineering Transport Phenomena, Rheology: Principles and Applications, Environmental Transport Processes, Advanced Engineering Analysis.

Honors and Awards

1. Mention cum laude in B.Sc. diploma, Universidad Simón Bolívar, 1978.
2. Award for Academic Excellence, conferred by Atlantic Richfield Company, University of California, Davis, 1981.
3. Award José Francisco Torrealba, conferred by the Association of Faculty Members, Universidad Simón Bolívar, for achievements in research, 1995.
4. Award Manuel Noriega Morales in the area of Applied Science and Technology, conferred by the Organization of American States, Washington, 1995. The award was conferred for contributions in the area of transport phenomena in porous media and multiphase flow.
5. Annual Award for Excellence at the Student Interface, College of Engineering, University of Arizona, 2000, 2002-2006, 2008-2012.
6. Outstanding Faculty Member, Graduate Student Achievement Awards, The University of Arizona, 2004.
7. Graduate and Professional Education Teaching and Mentoring Award, The University of Arizona, 2006.
8. Outstanding Faculty Member, The University of Arizona Accolades, 2010.
9. Distinguished Professor, since 2011.
10. ASEE Pacific Southwest Educator of the Year Award, 2013.

Publications

Articles in Conference Proceedings, Limited Circulation Journals, and Book Chapters

1. O'Laoghaire, D.T. and A.E. Sáez, An Analysis of the Capacity Expansion Problem for a Water Quality Management System, Acta Científica Venezolana, **30**, 105-115 (1979).
2. Solari, R.B., A.E. Sáez and C.A. Castillo, Distillation Columns Optimization by a Faster Convergence Procedure, Revista Técnica INTEVEP (Venezuela), **2**, 121-129 (1982).
3. Levec, J., A.E. Sáez and R.G. Carbonell, Holdup and Pressure Drop in Trickle-Bed Reactors, in Institution of Chemical Engineers Symposium Series No.87, London, pp.185-194, 1984.
4. Levec, J., A.E. Sáez and R.G. Carbonell, Holdup and Pressure Drop in Trickle-Bed Reactors, Chemistry and Industry, **34**, 21-24 (1985).
5. Otero, C., A.E. Sáez and I. Rusinek, Calculation of Absolute Permeabilities for Simulation Gridblocks with Shale Intercalations, in II International Symposium on Enhanced Oil Recovery. Technical Works, Vol. II, EDILUZ, Maracaibo, Venezuela, pp. 101-117, 1987.
6. Otero, C., A.E. Sáez and I. Rusinek, Effective Permeabilities for Heterogeneous Reservoirs, in Proceedings of the 4th. European Symposium on Enhanced Oil Recovery, DGMK, Hamburg, pp. 1019-1029, 1987.
7. Rodríguez-Prada, H.A. and A.E. Sáez, A Boundary Element Solution of the Stream Function-Vorticity Formulation of the Navier-Stokes Equations, in Numerical Methods in Laminar and Turbulent Flow, C. Taylor, W.G. Habashi and M.M. Hafez (eds.), Vol. V, Pineridge Press, Swansea, pp.312-323, 1987.
8. Sáez, A.E., Mathematical Model for the Simulation of Water Quality in River Networks, Acta Científica Venezolana, **39**, 294-303 (1988).
9. Müller A.J., A.E. Sáez, S. Rodríguez, C. Romero and M.L. Sargenti, Flow of Polymer Solutions through Porous Media: Influence of the Flow Distribution, in Proceedings of the Iberoamerican Polymer Symposium, Vigo, Spain, pp. 155-156, 1992.
10. Rodríguez, S., C. Romero, M.L. Sargenti, A.E. Sáez and A.J. Müller, The Flow of Poly(Ethylene

Oxide) Solutions through Nonconsolidated Porous Media, in Proceedings of the 3rd. Latin American Symposium on Polymers, Caracas, pp. 451-459, 1992.

11. Müller, E.A., A.E. Sáez and I. Rusinek, Calculation of Effective Absolute Permeabilities in Cross-Bedding Stratified Reservoirs, Latin American Applied Research, **22**, 41-48 (1992).

12. Müller, A.J., A.E. Sáez, S. Rodríguez, C. Romero and M.L. Sargenti, Flowing Polymers through Porous Media: Effects of Flow Distribution, in 3rd. Pan American Congress of Applied Mechanics. Proceedings, São Paulo, Brazil, pp. 323-326, 1993.

13. Gamboa, A.C., A.J. Müller and A.E. Sáez, Porous Media Flow of Blends of Semi-Rigid and Flexible Polymers in Solution, in Progress and Trends in Rheology IV: Proceedings of the Fourth European Rheology Conference, C. Gallegos (ed.), Steinkopff, Darmstadt, pp. 157-159, 1994.

14. Müller, A.J., A.C. Gamboa and A.E. Sáez, Flow of Solutions of Flexible and Semi-Flexible Polymers and their Blends through Porous Media, in Proceedings of the 4th Latin-American Polymer Symposium, Gramado, Brazil, pp. 372-379, 1994.

15. Gómez, M.G., F.F. Pironti and A.E. Sáez, Hydrodynamics and Mass Transfer in a Bubble Column with a Non-Newtonian Fluid, in Proceedings of the 5th. Latin-American Congress on Heat and Mass Transfer, Caracas, pp. IID.23.1- IID.23.12, 1994.

16. Da Silva, F.A., F.F. Pironti and A.E. Sáez, Distribution Of Solid Phase In Upward Gas-Liquid-Solid Flow through Conical Columns, in Proceedings of the 5th Thermal Sciences Brazilian Meeting, São Paulo, pp. 475-478, 1994.

17. Da Silva, F.A., L. Medina, O. Pérez-Martín, A.J. Müller and A.E. Sáez, Flow of Polymer Solutions through a Bidimensional Porous Medium, in Applied Mechanics in the Americas. Vol. III, L.A. Godoy, S.R. Idelsohn, P.A. Laura, D.T. Mook (eds.), American Academy of Mechanics, Buenos Aires, pp. 295-300, 1995.

18. Müller, A.J., A.E. Sáez, J.C. Tatham and J.A. Odell, Transition to Turbulence in Opposed Jets: Effect of Polymeric Additives, in Applied Mechanics in the Americas. Vol.III, L.A. Godoy, S.R. Idelsohn, P.A. Laura, D.T. Mook (eds.), American Academy of Mechanics, Buenos Aires, pp. 320-324, 1995.

19. Pironti, F.F., J. Fernández, R. Jiménez and A.E. Sáez, Numerical Prediction of Pressure Drops in Banks of Circular and Elliptical Tubes, in Proceedings of The Sixth FIDAP Users Conference, Fluid Dynamics International, Chicago, pp. 14.1-14.25, 1995.

20. Sáez, A.E. and A.J. Müller, Extension Thickening Effects in the Flow of Polymer Solutions through Porous Media, in Proceedings of the USB 25th Anniversary Polymer Meeting, Universidad Simón Bolívar, Caracas, pp. 63-74, 1995.

21. Sáez, A.E., M.L. Sargenti and A.J. Müller, Flow of Polymer Solutions through Disordered Packings of Mixtures of Monodisperse Spheres, in Proceedings of the XIIth International Congress on Rheology, A. Aït-Kadi, J.M. Dealy, D.F. James and M.C. Williams (eds.), Quebec City, p. 206, 1996.

22. Müller, A.J., R. Moreno, M. Rando, L. Smitter, P. Socías and A.E. Sáez, Extensional Flow of Solutions of Polymer Mixtures, in Proceedings of the XIIth International Congress on Rheology, A. Aït-Kadi, J.M. Dealy, D.F. James and M.C. Williams (eds.), Quebec City, p. 213, 1996.

23. Gestoso, P., A.J. Müller and A.E. Sáez, Two-Dimensional Flow of Newtonian and Non-Newtonian Fluids through Porous Media, in Proceedings of the XIIth International Congress on Rheology, A. Aït-Kadi, J.M. Dealy, D.F. James and M.C. Williams (eds.), Quebec City, pp. 377-378, 1996.

24. Moreno, R.A., A.J. Müller and A.E. Sáez, Mechanical Degradation of Polyacrylamide Solutions in Flow through Porous Media, in Proceedings of the III Venezuelan Congress in Chemistry, Universidad Central de Venezuela, Caracas, pp. 28-29, 1996.

25. Ventura-Medina, E., A.E. Sáez and F.F. Pironti, Liquid Mixing in a Concentric-Tube Bubble Column in Three-Phase Operation, in Proceedings of the 6th Latin American Congress on Heat and Mass Transfer, Florianopolis, Brazil, pp. 1309-1313, 1996.

26. Ramírez, N.E., J.B. Bello and A.E. Sáez, Mathematical Model for the Transport of Solids in Horizontal Pipes by Polymer Solutions, in Proceedings of the 6th Latin American Congress on Heat and

Mass Transfer, Florianopolis, Brazil, pp. 1405-1410, 1996.

27. Siquier, S., A. Ronchetti, M. Calderón, P. Llaguno and A.E. Sáez, Phase Distribution in Three-Phase Flows in Slurry Bubble Columns with a Conical Section, in Proceedings of the 6th Latin American Congress on Heat and Mass Transfer, Florianopolis, Brazil, pp. 1411-1416, 1996.

28. Moreno, R.A., A.J. Müller and A.E. Sáez, Degradation of Hydrolyzed Polyacrylamide in Porous Media Flows, in Proceedings of the 5th Latin American Polymer Symposium, Mar del Plata, Argentina, pp. 427-428, 1996.

29. Müller, A.J., R. Moreno and A.E. Sáez, Flow Induced Degradation in the Flow of Polymer Solutions through Porous Media, in Proceedings of the 5th Pan American Congress of Applied Mechanics, L.A. Godoy, M. Rysz, L.E. Suárez (eds.), University of Iowa Press, 1997.

30. Littlejohn, F., A.E. Sáez and C.S. Grant, Cleaning of Hydroxyapatite/Brushite Deposits from Stainless Steel Using a Sequestering Agent, in Fouling and Cleaning in Food Processing '98, D.I. Wilson, P.J. Fryer, A.P.M. Hasting (eds.), European Commission, Brussels, Belgium, pp. 214-221, 1999.

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32. Müller, A.J. and A.E. Sáez, The Rheology of Polymer Solutions in Porous Media, in Flexible Polymer Chain Dynamics in Elongational Flow: Theory and Experiment, T.Q. Nguyen and H -H. Kausch (eds.), Springer-Verlag, Heidelberg, pp. 335-393, 1999.

33. Müller, A.J., Y. Garcés, L. Patruyo, M. Torres, N. Ramírez and A.E. Sáez, The Flow and Surfactants and Polymer Solutions through Complex Flow Fields, Proceedings of the 5th Latin American and Caribbean Congress on Fluid Mechanics, Caracas, 2001.

34. Evans, R., A. Quach, D. Birnie, A.E. Sáez, W.P. Ela, B.J.J. Zelinski, G. Xia and H. Smith, Development of Polymeric Waste Forms for the Encapsulation of Toxic Wastes Using an Emulsion-Based Process, U.S. Department of Energy Journal of Undergraduate Research, **3**, 56-63 (2003).

35. Franks, C.J., A.P. Quach, G. Smith, H. Smith, D.P. Birnie, W. Ela, A.E. Sáez, B.J. Zelinski, Separation & Fixation of Toxic Components in Salt Brines Using a Water-Based Process, U.S. Department of Energy Journal of Undergraduate Research, **4**, 91-97 (2004).

36. Zelinski, B.J., R. Evans, A. Quach, D.P. Birnie, W.P. Ela, A.E. Sáez, G. Smith, H. Smith and G. Xia, Microstructure of Emulsion-Based Polymeric Waste Forms for Encapsulating Low-Level, Radioactive and Toxic Metal Wastes, Ceramic Transactions, **155**, 331-340 (2004).

37. Quach, A., G. Xia, R. Evans, A.E. Sáez, B.J. Zelinski, H. Smith, G. Smith, D.P. Birnie and W.P. Ela, Leach Resistance of Encapsulated Salts in Polymeric Waste Forms Fabricated Using an Aqueous-Based Route, Ceramic Transactions, **155**, 341-349 (2004).

38. Rengifo F., B. Garbo, A.P. Quach, W.P. Ela, A.E. Sáez, C. Franks, B.J. Zelinski, D.P. Birnie, G. Smith and H. Smith, Stabilization of Arsenic-Bearing Iron Hydroxide Solid Wastes in Polymeric Matrices, Ceramic Transactions, **168**, 99-108 (2005).

39. Rojas, M.R., C.E. Mendoza, S. Siquier, N. Ramírez, A.J. Müller and A.E. Sáez, Transport of Solids in a Non-Newtonian Annular Vertical Flow of Biopolymer Solutions, Engineering UCV Technical Journal (Venezuela), **21**, 57-69 (2006).

40. De Las Casas, C.L., K.G. Bishop, L.M. Bercik, M. Johnson, M. Potzler, W.P. Ela, A.E. Sáez, S.G. Huling and R.G. Arnold, In-Place Regeneration of Granular Activated Carbon Using Fenton's Reagents, in Innovative Approaches for the Remediation of Subsurface-Contaminated Hazardous Waste Sites: Bridging Flask and Field Scales, ACS Symposium Series, **940**, 43-65 (2006).

41. Rojas, M.R., O. Andara, A.J. Müller, S. Siquier, N. Ramírez and A.E. Sáez, Transport of Solids in Solutions of Biopolymer Mixtures and Improvements to their Distribution in a Flow Simulator in Vertical Conduits with Annular Cross Section, Engineering UCV Technical Journal (Venezuela), **23**, 43–51 (2008).

42. Rojas, M.R. and A.E. Sáez, Analysis of the Horizontal Pipeline Flow of Settling Dense Slurries, Proceedings of the 2010 International Conference on Multiphase Flow, University of Florida, 2010.

43. Blowers, P., J.A. Field, K. Ogden, A.E. Sáez and R. Sierra, ChE at The University of Arizona, Chemical Engineering Education, **45**, 2-7 (2011).

Articles in Journals

1. Solari, R.B., A.E. Sáez, I. D'Apollo and A. Bellet, Velocity Distributions and Liquid Flow Patterns in Industrial Sieve Trays, Chemical Engineering Communications, **13**, 369-384 (1982).
2. Sáez, A.E. and B.J. McCoy, Dynamic Response of a Packed-Bed Thermal Storage System - A Model for Solar Air Heating, Solar Energy, **29**, 201-206 (1982).
3. Sáez, A.E. and B.J. McCoy, Transient Analysis of Packed-Bed Thermal Storage Systems, International Journal of Heat and Mass Transfer, **26**, 49-54 (1983).
4. Sáez, A.E. and R.G. Carbonell, Hydrodynamic Parameters for Gas-Liquid Cocurrent Flow in Packed Beds, AIChE Journal, **31**, 52-62 (1985).
5. Sáez, A.E. and R.G. Carbonell, On the Performance of Quadrilateral Finite Elements in the Solution to the Stokes Equations in Periodic Structures, International Journal for Numerical Methods in Fluids, **5**, 601-614 (1985).
6. Sáez, A.E., R.G. Carbonell and J. Levec, The Hydrodynamics of Trickling Flow in Packed Beds. Part I: Conduit Models, AIChE Journal, **32**, 353-368 (1986).
7. Levec, J., A.E. Sáez and R.G. Carbonell, The Hydrodynamics of Trickling Flow in Packed Beds. Part II: Experimental Observations, AIChE Journal, **32**, 369-380 (1986).
8. Sáez, A.E. and R.G. Carbonell, The Equilibrium Shape and Stability of Menisci Formed between Two Touching Cylinders, Journal of Fluid Mechanics, **176**, 357-378 (1987).
9. Sáez, A.E., C. Otero and I. Rusinek, The Effective Homogeneous Behavior of Heterogeneous Porous Media, Transport in Porous Media, **4**, 213-238 (1989).
10. Rodríguez-Prada, H.A., F.F. Pironti and A.E. Sáez, Fundamental Solutions of the Stream Function-Vorticity Formulation of the Navier-Stokes Equations, International Journal for Numerical Methods in Fluids, **10**, 1-12 (1990).
11. Pino, L.Z., M.M. Yépez, A.E. Sáez and G. De Drago, An Experimental Study of Gas Holdup in Two-Phase Bubble Columns with Foaming Liquids, Chemical Engineering Communications, **89**, 155-175 (1990).
12. Ramírez, N.E. and A.E. Sáez, The Effect of Variable Viscosity on Boundary-Layer Heat Transfer in a Porous Medium, International Communications in Heat and Mass Transfer, **17**, 477-488 (1990).
13. Otero, C., A.E. Sáez and I. Rusinek, Effective Permeabilities for Model Heterogeneous Porous Media, In Situ, **14**, 229-244 (1990).
14. Pino, L.Z., M.M. Yépez, and A.E. Sáez, Hydrodynamics of a Semibatch Slurry Bubble Column with a Foaming Liquid, AIChE Journal, **36**, 1758-1762 (1990).
15. Sáez, A.E. and R.G. Carbonell, The Equilibrium and Stability of Menisci between Touching Spheres under the Effect of Gravity, Journal of Colloid and Interface Science, **140**, 408-418 (1990).
16. Sáez, A.E., J.C. Perfetti and I. Rusinek, Prediction of Effective Diffusivities in Porous Media Using Spatially Periodic Models, Transport in Porous Media, **6**, 143-157 (1991).
17. Siquier, S., M.M. Yépez and A.E. Sáez, Solid Distribution in a Slurry Bubble Column with Two Immiscible Liquid Phases, AIChE Journal, **37**, 466-469 (1991).
18. Estévez, L.A., L.Z. Pino, I. Cavicchioli and A.E. Sáez, Effect of Surfactant Concentration on Gas Holdup in a Bubble Column with an Organic Liquid, Chemical Engineering Communications, **105**, 231-239 (1991).
19. Sáez, A.E., M.M. Yépez, C. Cabrera and E. Soria, Static Liquid Holdup in Packed Beds of Spherical Particles, AIChE Journal, **37**, 1733-1736 (1991).
20. Pino, L.Z., R.B. Solari, S. Siquier, L.A. Estévez, M.M. Yépez and A.E. Sáez, Effect of Operating Conditions on Gas Holdup in Slurry Bubble Columns with a Foaming Liquid, Chemical Engineering Communications, **117**, 367-382 (1992).
21. Argüelles, C., M.M. Yépez and A.E. Sáez, Hydrodynamics of Bubble Columns with Two

Immiscible Liquid Phases, Chemical Engineering Communications, **122**, 201-212 (1993).

22. Rodríguez, S., C. Romero, M.L. Sargenti, A.J. Müller, A.E. Sáez and J.A. Odell, Flow of Polymer Solutions through Porous Media, Journal of Non-Newtonian Fluid Mechanics, **49**, 63-85 (1993).

23. Müller, A.J., L.I. Medina, O. Pérez-Martín, S. Rodríguez, C. Romero, M.L. Sargenti and A.E. Sáez, Flowing Polymers through Porous Media: an Experimental Study of Flow Distribution, Polymer Degradation and Molecular Weight Effects, Applied Mechanics Reviews, **46**, S63-S70 (1993).

24. Sáez, A.E. and N.E. Ramírez, Boundary Layer Flow and Heat Transfer in Saturated and Unsaturated Porous Media, European Journal of Mechanics B/Fluids, **12**, 701-727 (1993).

25. Müller, A.J., V. Balsamo, F. Da Silva, C.M. Rosales and A.E. Sáez, Shear and Elongational Behavior of Linear Low Density and Low Density Polyethylene Blends from Capillary Rheometry, Polymer Engineering & Science, **34**, 1455-1463 (1994).

26. Sáez, A.E., A.J. Müller and J.A. Odell, Flow of Monodisperse Polystyrene Solutions through Porous Media, Colloid and Polymer Science, **272**, 1224-1233 (1994).

27. Gamboa, A.C., A.E. Sáez and A.J. Müller, Flow of Solutions of Hydroxypropyl Guar - Poly(Ethylene Oxide) Mixtures through a Porous Medium, Polymer Bulletin, **33**, 717-724 (1994).

28. Pino, L.R.Z. and A.E. Sáez, Thermal Dispersion in Vertical Gas-Liquid Flow with Foaming and Non-Foaming Liquids, International Communications in Heat and Mass Transfer, **22**, 391-400 (1995).

29. Müller, A.J., A.E. Sáez and J.A. Odell, Turbulence Suppression by Polymer Solutions In Opposed Jets Flow, AIChE Journal, **41**, 1333-1336 (1995).

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31. Da Silva, F.A., F.F. Pironti and A.E. Sáez, The Sedimentation-Dispersion Model for Slurry Bubble Columns with a Conical Distributor, Chemical Engineering Communications, **138**, 157-170 (1995).

32. Müller, A.J., A.E. Sáez, J.P. Tatham and J.A. Odell, Effect of Polymeric Additives on Turbulent Flow in Opposed Jets, Applied Mechanics Reviews, **48**, S216-S221 (1995).

33. Pironti, F.F., V.R. Medina, R. Calvo and A.E. Sáez, Effect of Draft Tube Position on the Hydrodynamics of a Draft Tube Slurry Bubble Column, The Chemical Engineering Journal, **60**, 155-160 (1995).

34. Bello, J.B., A.J. Müller and A.E. Sáez, Effect of Intermolecular Cross Links on Drag Reduction by Polymer Solutions, Polymer Bulletin, **36**, 111-118 (1996).

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38. Moreno, R.A., A.J. Müller and A.E. Sáez, Flow-Induced Degradation of Hydrolyzed Polyacrylamide in Porous Media, Polymer Bulletin, **37**, 663-670 (1996).

39. Kabin, J.A., A.E. Sáez, C.S. Grant and R.G. Carbonell, Removal of Organic Films from Rotating Disks Using Aqueous Solutions of Nonionic Surfactants: Film Morphology and Cleaning Mechanisms, Industrial & Engineering Chemistry Research, **35**, 4513-4525 (1996).

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41. Yan., J -F., A.E. Sáez and C.S. Grant, The Removal of Oil Films from Stainless Steel Tubes, AIChE Journal, **43**, 251-259 (1997).

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