

STEEN, Paul H.
Maxwell Upson Professor in Engineering, Cornell University

https://en.wikipedia.org/wiki/Paul_H._Steen

<https://www.cheme.cornell.edu/faculty-directory/paul-h-steen>

Education:	Brown University	Engineering	1975 ScB
	Brown University	English Literature	1975 AB
	Johns Hopkins University	Fluid Dynamics	1981 PhD
	Stanford University	Chemical Engineering	1981-2 postdoc

Appointments: Maxwell M. Upson Professor in Engineering, 2008 - present.
Professor, 1994-2008,
Associate Professor, 1988-1994,
Assistant Professor, Chemical & Biomolecular Engineering, 1982-1988.
Center for Applied Mathematics, Field Member, 1984 - present.
Theoretical & Applied Mechanics, Field Member, 2003- present.
Mechanical and Aerospace Engineering, Field Member, 2011-present.

Honors: Fellow, American Institute of Chemical Engineers, 2013.
Fellow, American Physical Society, 1996.
Henry Marion Howe Medal, 2007.
Alexander von Humboldt Fellow 1990, 1996, 2011 & 2019.

Visiting App: Physics of Fluids group, University of Twente, Netherlands, 2011, 2018.
Max Planck Institute for DSO, Goettingen, Germany, 2011.
IMA Visitor (U Minn.), Complex Fluids & Flows, 10-12/2009.
Senior Visiting Scientist, FZK Karlsruhe, 2003-04; 1996.

Activities Professional (selected):

Associate Editor, *Microgravity/Nature Partner Journal*, 2014-present.
US National Committee on Theoretical & Applied Mechanics, 2016-19.
IUTAM Symposium co-organizer, *Stochastic Fluid Flow Transitions*, 2018
Associate Editor, *Journal of Fluid Mechanics*, 2000-2012.
American Physical Society/ Division of Fluid Dynamics, committee service:
Corrsin Award, 2013-14, Chair 2014; Nominations, 2010-2012;
Executive, 2005-08; Program, 2004-06; Publications, 2001-03; Acrivos
Dissertation Award, 2007-2008, Chair, 2008; Fluid Dynamics Prize
selection, 2001-03, Chair, 2003; Frenkiel Award, 1999-2000.
Gordon Conference (Chair), “Gravitational effects in Physico-chemical systems”,
New London, NH, 8-13 July, 2001;
(vice-Chair), Henniker, NH, 27 June-2 July, 1999.
Euromech 408 (co-Chair), “Interactive Dynamics of Convection &
Solidification”, Chamonix, FR, 18-22 March, 2000.
NASA Panel (Chair), Review for Fluid Physics NRA (dynamics & stability), 3-6
June 1997, and 6-8 March 2003.

International Outreach: Radio, TV and media interviews, coverage.

<https://sites.google.com/site/mikevogelpersonal/home/pnas-secad-news-links>

Licensed Patents

US Patent 8,998,584 (2015), “Electro-osmotic apparatus, method & applications,” w/ MJ Vogel.
US Patent 8,992,183 (2015), “System & methods for object manipulation,” w/ H. Lipson & group.
This SECAD technology [38] is licensed to InCaveo, a Bay-area start-up (5 November 2019).

Patent Activity

- P1. US Patent Appl.16/039265 (2019), “Resonantly-driven Drop Contact-line Mobility Measurement.”
- P2. US Patent 8,992,183 (2015), “System & methods for object manipulation,” w/ H. Lipson & group.
- P3. US Patent 8,998,584 (2015), “Electro-osmotic apparatus, method & applications,” w/ MJ Vogel.
- P4. US Patent 8,319,126 (2012), “Liquid switches & switching devices . . .,” w/ P Ehrhard, MJ Vogel.
- P5. US Patent 7,306,025 (2007), “Methods for continuous casting of a molten material”
- P6. US Patent 7,082,986 (2006), “System & method for continuous casting of a molten material”

Publications

Papers

1. Wesson E, Steen P. “Steiner triangular drop dynamics.” *Chaos: An Interdisciplinary Journal of Nonlinear Science*. 2020 Feb 5;30(2):023118. <https://doi.org/10.1063/1.5113786> **featured/Scilight
2. Xia, Yi, and Paul H. Steen. "Dissipation of oscillatory contact lines using resonant mode scanning." *npj Microgravity* 6.1 (2020): 1-7. doi.org/10.1038/s41526-019-0093-0
3. Ludwicki, JM, FL Robinson and PH Steen. “Switchable Wettability for Condensation Heat Transfer,” 2020 ACS Appl. Mater. Interfaces. doi.org/10.1038/s41526-019-0093-0.
4. Ludwicki, JM and PH Steen. “Sweeping by Sessile Drop Coalescence,” *The European Physical Journal Special Topics*, accepted.
5. Macner AM, Daniel S, Steen PH. Simulating Heat Transfer During Transient Dropwise Condensation on a Low-Thermal-Conductivity Substrate. *Langmuir*. 2019 Aug 5;35(35):11566-78. doi.org/10.1021/acs.langmuir.9b01231
6. van der Meulen, M-J, PH Steen, H Reintgen, H Wijshoff, M Versluis, and D Lohse, “Non-axisymmetric effects in drop-on-demand piezo-acoustic inkjet printing,” *Phys. Rev. Appl*, accepted.
7. Hagen, TC, and PH Steen, “Volume-scavenging of networked droplets,” *Physica D*, 2019, 394:1-15, <https://doi.org/10.1016/j.physd.2019.01.005>.
8. Steen, PH, CT Chang and JB Bostwick, “Droplet motions fill a periodic table,” *Proc. Nat. Acad. Sci.*, 2019: 116(11), 4849-4854. [doi/10.1073/pnas.1817065116](https://doi.org/10.1073/pnas.1817065116).
9. Yu Z, Y Yong, D An, W Song, Q Liu, L Wang, Y Pardo, VR Kern, PH Steen, W Hong, Z Liu and M Ma, “A Drip-Cross-linked Tough Hydrogel,” *Polymer*, 2018, 135, 327–330. doi.org/10.1016/j.polymer.2017.12.036
10. Mattson, JW, EA Theisen, and PH Steen, “Rapid Solidification Forming of Glassy and Crystalline Ribbons by Planar Flow Casting,” *Chem. Eng. Sci.* 2018, <https://doi.org/10.1016/j.ces.2018.07.017>
11. Xia, Yi, and PH. Steen. "Moving contact-line mobility measured." *J Fluid Mech.*, 841 (2018): 767-783. <https://doi.org/10.1017/jfm.2018.105>

12. Bostwick, JB and PH Steen, "Static rivulet instabilities: varicose and sinuous modes," J. Fluid Mech., 2018, 837, 819-838 <https://doi.org/10.1017/jfm.2017.876>.
13. Chang, CT, S Daniel and PH Steen, "Footprint geometry and Sessile Drop Resonance," Phys. Rev. E. 2017. doi.org/10.1103/PhysRevE.95.033109
14. ** Steen, PH and W Brutsaert, "Saph and Schoder and the friction Law of Blasius," Annu. Rev. Fluid Mech. 2017. [doi:10.1146/annurev-fluid-080316-121100](https://doi.org/10.1146/annurev-fluid-080316-121100). **invited
15. Bostwick, JB and PH Steen, "Response of driven sessile drops with contact-line dissipation." Soft Matter, 2016, 12, 8919 – 8926. doi:[10.1039/C6SM01928E](https://doi.org/10.1039/C6SM01928E)
16. Bostwick, JB, and PH Steen, "Dynamics of sessile drops. Part 3. Theory of forced oscillations." <http://arxiv.org/abs/1605.05533>.
17. An, D, A Warning, KG Yancey, CT Chang, VR Kern, AK Datta, PH Steen, D Luo, and M Ma. "Mass production of shaped particles through vortex ring freezing," Nature communications, August 4, 2016 doi:[10.1038/ncomms12401](https://doi.org/10.1038/ncomms12401).
18. Bostwick, JB, and PH Steen. "Liquid-bridge shape stability by energy bounding." IMA Journal of Applied Mathematics (2015) doi: [10.1093/imamat/hxv016](https://doi.org/10.1093/imamat/hxv016).
19. ** Bostwick, JB and PH Steen, "Stability of constrained capillary surfaces," Annu. Rev. Fluid Mech. 2015. 47:539–68 [doi:10.1146/annurev-fluid-010814-013626](https://doi.org/10.1146/annurev-fluid-010814-013626). **invited
20. Chang, CT, JB Bostwick, S Daniel and PH Steen, "Dynamics of Sessile Drops. Part 2. Experiment." J. Fluid Mech. (2015), vol. 768, pp. 442-467. doi:[10.1017/jfm.2015.99](https://doi.org/10.1017/jfm.2015.99).
21. Bostwick, JB and PH Steen, "Dynamics of Sessile Drops. Part 1. Inviscid theory." J. Fluid Mech. 2014; 760: 5-38. doi:[10.1017/jfm.2014.582](https://doi.org/10.1017/jfm.2014.582).
22. Altieri, AL and PH Steen. "Substrate heating in the planar-flow melt spinning of metals." J. Thermal Sci. Eng. Appl. 2014; 6(4):041011-041011-9. doi: [10.1115/1.4027809](https://doi.org/10.1115/1.4027809)
23. Altieri, AL and PH Steen, "Adhesion upon solidification and detachment in the melt-spinning of metals," 2014, Met. & Mat. Trans. B doi: [10.1007/s11663-014-0128-6](https://doi.org/10.1007/s11663-014-0128-6).
24. Macner, AM, S Daniel and PH Steen, "Condensation on Surface Energy Gradient Shifts Drop Size Distribution toward Small Drops," Langmuir, 2014. <http://pubs.acs.org/doi/abs/10.1021/la404057g>
25. Macner, AM and PH Steen, "Adaptive Adhesion by a Beetle: Manipulation of liquid bridges and their breaking limits," Biointerphases 9, 011001, 2014. <http://dx.doi.org/10.1116/1.4857315>.
26. Barz, DPJ, and PH Steen, "A dynamic model of the electroosmotic droplet switch," Phys. Fluids 25, 097104, 2013. <http://dx.doi.org/10.1063/1.4821356>
27. Chang, C-T, JB Bostwick, PH Steen and S. Daniel, "Substrate constraint modifies the Rayleigh spectrum of vibrating sessile drops," Phys. Rev. E 88, 023015, 2013. <http://dx.doi.org/10.1103/PhysRevE.88.023015>
28. Cox, BL, and PH Steen, "'Herringbone' defect formation in planar-flow melt spinning," Journal of Materials Processing Technology, 2013. doi: <http://dx.doi.org/10.1016/j.jmatprotec.2013.04.009>

29. Slater, DM. and PH Steen, "Detecting symmetry in the chaotic and quasiperiodic motions of three coupled droplet oscillators," SIAM J. Appl. Dyn. Sys. 11(3), 1098-1113. 2012.
doi: <http://dx.doi.org/10.1137/110840327>
30. Bostwick, JB and PH Steen, "Coupled oscillations of deformable spherical-cap droplets. Part 2. Viscous motions," J. Fluid Mech. doi: <http://dx.doi.org/10.1017/jfm.2012.480>
31. Bostwick, JB and PH Steen, "Coupled oscillations of deformable spherical-cap droplets. Part 1. Inviscid motions," J. Fluid Mech. doi: <http://dx.doi.org/10.1017/jfm.2012.483>
32. Slater, DM, MJ Vogel, AM Macner, and PH Steen, "Beetle-inspired adhesion by capillary-bridge arrays: pull-off detachment," J. Adhes. Sci. Tech. 2012.
doi: <http://dx.doi.org/10.1080/01694243.2012.705472>
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35. Slater, DM and PH Steen, "Bifurcation and Stability of n coupled droplet oscillators with Sn symmetry," SIAM J. Appl. Math., Vol. 71, No. 4, pp. 1204–1219, 2011.
doi: <http://dx.doi.org/10.1137/100808940>
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39. Theisen, EA, MJ Davis, SJ Weinstein and PH Steen "Transient behavior of the planar-flow melt spinning process," Chem. Eng Sci. 65(10) 2010. doi: <http://dx.doi.org/10.1016/j.ces.2010.02.018>
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41. Barz, DPJ, MJ Vogel and PH Steen, "Determination of the zeta potential of porous substrates by droplet deflection. I. The influence of ionic strength and pH value of an aqueous electrolyte in contact with a borosilicate surface," Langmuir 25(3), 1842-1850. 2009.
doi: <http://dx.doi.org/10.1021/la802949z>
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43. van Lengerich, HB, MJ Vogel and PH Steen, "Dynamics and Stability of Volume-Scavenging Drop Arrays: Coarsening by Capillarity," Physica D **238**, 531-539, 2009.
doi: <http://dx.doi.org/10.1016/j.physd.2008.12.001>
44. Slater, DM, CA Lopez, AH Hirsra and PH Steen, "Chaotic motion of a forced droplet-droplet oscillator," Phys. Fluids. **20**, 092107, 2008. doi: <http://dx.doi.org/10.1063/1.2982372>

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69. Chen, Y.-J. and P. H. Steen. "Stabilizing Interfaces of Finite Extent with Flow Induced by Thermal Convection", in *Advances in Multi-fluid Flows*, SIAM publishers, 211-18 (1996). doi:[266034684](https://doi.org/10.1137/1996266034684)
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71. Chen, Y.-J. and P. H. Steen. "Suppression of the capillary instability in the Rayleigh-Taylor slot problem", *Phys. Fluids* 8(1), 97-102. (1996). doi: <http://dx.doi.org/10.1063/1.868818>
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Invited and Contributed Talks: Seminars, Colloquia and Workshops

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Academic supervision

PhD degrees (24): Matthew J Russo, Steven A Cryer, J Kent Carpenter, Michael D Graham, Brian J Lowry, Wenjie Hu, Yi-Ju Chen, Barry L Reed, Nathaniel D Robinson, Cormac J Byrne, Eric A Theisen, David M Slater, Brenton L Cox, Henrik B van Lengerich, Joshua B Bostwick, Anthony L Altieri, ChunTi Chang; Ashley M Macner; Elizabeth N Wesson.

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