

HONG-QUAN (HOLDEN) ZHANG

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Degrees Earned

1988: PhD, Fluid Mechanics, Tianjin University, China

1985: MSc, Thermal Energy Engineering, Xian Jiaotong University, China

1982: BSc, Thermal Energy Engineering, Xian Jiaotong University, China

Areas of Expertise

Multiphase Flow in Wells and Pipelines, Artificial Lift, Heat and Mass Transfer, Fluid Mechanics, CFD, Heavy Oil and Emulsion Rheology, Experimental Techniques for Fluid Flow, Oil and Gas Production, and Flow Assurance Technology

Experience

- Currently: Associate Professor, McDougall School of Petroleum Engineering, The University of Tulsa, Director of Tulsa University Artificial Lift Projects (TUALP, www.tualp.utulsa.edu) and Tulsa University High-Viscosity Oil Projects (TUHOP, www.tuhop.utulsa.edu)
- 8/2003 – 8/2009 Assistant Professor, The University of Tulsa
- 8/2003 – 4/2012 Associate Director of Tulsa University Fluid Flow Projects (TUFFP)
- 5/1998 – 8/2003: Senior Research Associate, TUFFP and Tulsa University Paraffin Deposition Projects (TUPDP)
- 12/1994 – 5/1998: Associate Professor and Professor, Tianjin University, China
- 1/1993 – 12/1994: Alexander von Humboldt Research Fellow, Max-Planck-Institute of Fluid Mechanics and German Aerospace Research Establishment, Göttingen, Germany
- 9/1988 – 1/1993: Lecturer and Associate Professor, Tianjin University, China

Professional Memberships

- Member, Society of Petroleum Engineers (SPE) #3007014, 1998 – present
- Member, American Society of Mechanical Engineers (ASME) #6729529, 1999 – 2002
- Member, American Institute of Chemical Engineers (AIChE) #90153106, 2002
- Member, American Institute of Aeronautics and Astronautics (AIAA) #169830, 1998 – 1999

Awards and Prizes

2012: Outstanding Service Award (as SPE Journal Technical Editor)

2011: Outstanding Associate Editor Award (SPE Journal)

2007: Zelimir Schmidt Award for Outstanding Research, College of Engineering and Natural Sciences, The University of Tulsa

2001: ASME Jacobson Best Paper Award, USA
1996: Tianjin Excellent New Product Prize, China
1993: Alexander von Humboldt Research Fellowship and Equipment Awards, Germany
1991: State Education Commission Scientific and Technological Advancement Prize, China

Publications

Peer-Reviewed Journals

1. K.L. Magrini, C. Sarica, A. Al-Sarkhi and **H.-Q. Zhang**, 2010, "Liquid Entrainment in Annular Gas/Liquid Flow in Inclined Pipes," *SPE Journal*, June 2012, pp. 617-630.
2. **H.-Q. Zhang**, C. Sarica and E. Pereyra, 2012, "Review of High-Viscosity Multiphase Pipe Flow," *Energy & Fuels*, **26**, pp. 3979-3985.
3. **H.-Q. Zhang**, D. Vuong and C. Sarica, 2012, "Modeling High-Viscosity Oil/Water Flows in Horizontal and Vertical Pipes," *SPE Journal*, March 2012, pp. 243-249.
4. C. Sarica, **H.-Q. Zhang** and R.J. Wilkens, 2011, "Sensitivity of Slug Flow Mechanistic Models on Slug Length," *ASME J. Energy Resources Technology*, December 2011, **133**.
5. **H.-Q. Zhang** and C. Sarica, 2011, "A Model for Wetted Wall Fraction and Gravity Center of Liquid Film in Gas/Liquid Pipe Flow," *SPE Journal*, September 2011, pp. 692-697.
6. **H.-Q. Zhang** and C. Sarica, 2011, "Low Liquid Loading Gas/Liquid Pipe Flow," *J. Natural Gas Science and Engineering* **3**, pp. 413-422.
7. A.K. Sharma, A.S. Al Sarkhi, C. Sarica and **H.-Q. Zhang**, 2011, "Modeling of Oil-Water Flow Using Energy Minimization Concept," *Int. J. Multiphase Flow* **37**, pp. 326-335.
8. T.T. Yu, **H.-Q. Zhang**, M.X. Li and C. Sarica, 2010, "A Mechanistic Model for Gas/Liquid Flow in Upward Vertical Annuli," *SPE Production & Operations*, August 2010, pp. 285-295.
9. S. Atmaca, C. Sarica, **H.-Q. Zhang** and A.S. Al-Sarkhi, 2009, "Characterization of Oil Water Flows in Inclined Pipes," *SPE Project, Facilities & Construction*, June 2009.
10. M. Vielma, S. Atmaca, C. Sarica and **H.-Q. Zhang**, 2008, "Characterization of Oil-Water Flows in Horizontal Pipes," *SPE Project, Facilities & Construction*, December 2008.
11. E.M. Al-Safran, C. Sarica, **H.-Q. Zhang** and J.P. Brill, 2008, "Mechanistic/ Probabilistic Modeling of Slug Initiation in a Lower Elbow of a Hilly-terrain Pipeline," *SPE Production & Operations*, February, pp. 88-99.
12. Y.-Q. Fan, Q. Wang, **H.-Q. Zhang**, C. Sarica and T.J. Dannielsen, 2007, "A Model to Predict Liquid Holdup and Pressure Gradient of Near-Horizontal Wet-Gas Pipelines," *SPE Project, Facilities & Construction* **2**(2), pp. 1-8.
13. **H.-Q. Zhang**, C. Sarica, 2006, "Unified Modeling of Gas/Oil/Water Pipe Flow – Basic Approaches and Preliminary Validation," *SPE Project Facilities & Construction* **1**(2), pp. 1-7.
14. **H.-Q. Zhang**, Q. Wang, C. Sarica, and J.P. Brill, 2005, "Unified Model of Heat Transfer in Gas-Liquid Pipe Flow," *SPE Production & Operations* **21**(11), pp. 114-122.
15. E.M. Al-Safran, C. Sarica, **H.-Q. Zhang** and J.P. Brill, 2005, "Investigation of Slug Flow Characteristics in the Valley of a Hilly-Terrain Pipeline," *Int. J. Multiphase Flow* **31**, pp. 337-357.
16. E.M. Al-Safran, C. Sarica, **H.-Q. Zhang** and J.P. Brill, 2005, "Probabilistic/Mechanistic Modeling of Slug Length Distribution in Horizontal Pipelines," *SPE Production and Facilities* **20**(2), pp. 160-172.

17. **H.-Q. Zhang**, Q. Wang, C. Sarica and J.P. Brill, 2003, "Unified Model for Gas-Liquid Pipe Flow via Slug Dynamics – Part 1: Model Development," *ASME J. Energy Resources Technology* **125**, pp 266-273.
18. **H.-Q. Zhang**, Q. Wang, C. Sarica and J.P. Brill, 2003, "Unified Model for Gas-Liquid Pipe Flow via Slug Dynamics – Part 2: Model Validation," *ASME J. Energy Resources Technology* **125**, pp 274-283.
19. N.R. Olive, **H.-Q. Zhang**, Q. Wang, C.L. Redus and J.P. Brill, 2003, "Experimental Study of Low Liquid Loading Gas-Liquid Flow in Near-Horizontal Pipes," *ASME J. Energy Resources Technology* **125**, pp 294-298.
20. **H.-Q. Zhang**, E.M. Al-Safran, S.S. Jayawardena, C.L. Redus, C. Sarica and J.P. Brill, 2003, "Modeling of Slug Dissipation and Generation in Gas-Liquid Hilly-Terrain Pipe Flow," *ASME J. Energy Resources Technology* **125**, pp 161-168.
21. **H.-Q. Zhang**, Q. Wang, C. Sarica and J.P. Brill, 2003, "A Unified Mechanistic Model for Slug Liquid Holdup and Transition between Slug and Dispersed Bubble Flows," *Int. J. Multiphase Flow* **29**, pp. 97-107.
22. B. Matzain, M. Apte, **H.-Q. Zhang**, M. Volk, J.P. Brill and J. Creek, 2002, "Investigation of Paraffin Deposition during Multiphase Flow in Pipelines and Wellbores – Part 1: Experiments," *ASME J. Energy Resources Technology* **124**, pp.180-186.
23. M.S. Apte, A. Matzain, **H.-Q. Zhang**, M. Volk, J.P. Brill and J.L. Creek, 2001, "Investigation of Paraffin Deposition during Multiphase Flow in Pipelines and Wellbores – Part 2: Modeling," *ASME J. Energy Resources Technology* **123**, pp.150-157.
24. **H.-Q. Zhang**, H. Yuan, C.L. Redus and J.P. Brill, 2000, "Observations of Slug Dissipation in Downward Flow," *ASME J. Energy Resources Technology* **122**, pp.110-114.
25. X.T. Chen, **H.-Q. Zhang**, C.L. Redus and J.P. Brill, 2000, "Pressure Loss/Gain Boundary of Gas-Liquid Downward Flow in Inclined and Vertical Pipes," *ASME J. Energy Resources Technology* **122**, pp.83-87.
26. **H.-Q. Zhang**, S.S. Jayawardena, C.L. Redus and J.P. Brill, 2000, "Slug Dynamics in Gas-Liquid Pipe Flow," *ASME J. Energy Resources Technology* **122**, pp.14-21.
27. **H.-Q. Zhang**, 1997, "Streamwise Vortices in a Plane Mixing Layer and Rayleigh's Centrifugal Instability," *Acta Mechanica Sinica* **29** (2), p.129 (Chinese).
28. **H.-Q. Zhang**, U. Fey, B.R. Noack, M. Koenig and H. Eckelmann, 1995, "On the Transition of the Cylinder Wake," *Physics of Fluids* **7** (4), p.779.
29. **H.-Q. Zhang**, 1993, "A Numerical Study of Vortex Shedding from a Circular Cylinder in Plane Mixing Layers," *Acta Mechanica Sinica* **25** (3), p.356 (Chinese).
30. **H.-Q. Zhang** and W. Shu, 1991, "The Effects of Velocity Ratio on the Large Scale Coherent Structures in Free Shear Layers," *Chinese J. Aeronautics* **4** (3), p.258.
31. **H.-Q. Zhang** and W. Shu, 1990, "Effects of Perturbation Phase Differences on the Large Scale Coherent Structures in Free Shear Layers," *Acta Aerodynamica Sinica* **8** (1), p.18 (Chinese).
32. **H.-Q. Zhang** and W. Shu, 1990, "An Experimental Study of the Large Scale Coherent Structures in a Forced Free Shear Layer," *Acta Mechanica Sinica* **6** (1), p.9.
33. **H.-Q. Zhang** and W. Shu, 1990, "Numerical Simulations of Vortex Merging and Vortex Splitting in Mixing Layers," *Science in China A* **33** (6), p.686.
34. **H.-Q. Zhang** and W. Shu, 1990, "A Numerical Simulations of Vortex Merging in Free Shear Layer," *Acta Mechanica Sinica* **21** (2), p.154.

Refereed Conference Proceedings

1. S. Sridhar, **H.-Q. Zhang**, C. Sarica and E. Pereyra, 2011, "Experiments and Model Assessment on High-Viscosity Oil/Water Inclined Pipe Flows," SPE 146448, SPE ATCE, October 30 – November 2, 2011, Denver.
2. G. Ersoy, C. Sarica, E.M. Al-Safran and **H.-Q. Zhang**, 2011, "Experimental Investigation of Three-Phase Gas-Oil-Water Slug Flow Evolution in Hilly-Terrain Pipelines," SPE 146448, SPE ATCE, October 30 – November 2, 2011, Denver.
3. D.T. Akhiyarov, **H.-Q. Zhang** and C. Sarica, 2010, "High-Viscosity Oil-Gas Flow in Vertical Pipe," OTC 20617, Offshore Technology Conference, May 3-6, 2010, Houston
4. D.H. Vuong, **H.-Q. Zhang**, C. Sarica and M.X. Li, 2009, "Experimental Study on High Viscosity Oil/Water Flow in Horizontal and Vertical Pipes," SPE 124181, SPE ATCE, October 4-7, 2009, New Orleans.
5. **H.-Q. Zhang**, C. Sarica and J.P. Brill, 2009, "An Overhead Receiver for Capture, Reformation, Storage and Transportation of Gas Hydrates Produced from Deepwater Sediments," OTC 19885, Offshore Technology Conference, May 4-7, 2009, Houston.
6. **H.-Q. Zhang**, C. Sarica and J.P. Brill, 2008, "A Method of Harvesting Hydrates from Marine Sediments," 6th International Conference on Gas Hydrates, July 6-10, 2008, Vancouver, Canada.
7. X.-H. Chen, Y. Tsang, **H.-Q. Zhang** and T.X. Chen, 2007, "Pressure-Wave Propagation Technique for Blockage Detection in Subsea Flowlines," SPE 110570, ATCE, November 12-14, 2007, Anaheim, CA.
8. K. Cengizhan, **H.-Q. Zhang** and C. Sarica, 2007, "Identification and Classification of New Three-Phase Gas/Oil/Water Flow Patterns," SPE 110221, ATCE, November 12-14, 2007, Anaheim, CA.
9. B. Gokcal, Q. Wang, **H.-Q. Zhang** and C. Sarical, 2006, "Effects of High Oil Viscosity on Oil-Gas Flow Behavior in Horizontal Pipes," SPE 102727, ATCE, September 24-27, 2006, San Antonio, TX.
10. C. Beltran, C. Sarica, **H.-Q. Zhang**, 2006, "Severe Slugging Prediction for Gas-Oil-Water Flow in Pipeline-Riser Systems," BHR Group 5th North American Conference on Multiphase Technology, May 31 – June 2, 2006, Banff, Canada.
11. M.S. Hossain, C. Sarica, **H.-Q. Zhang**, L. Rhyne, K. Greenhill, 2005, "Assessment and Development of Heavy Oil Viscosity Correlations," SPE 97907, ITOHOS 2005, November 1-3, 2005, Calgary, Canada.
12. E.M. Al-Safran, C. Sarica, **H.-Q. Zhang** and J.P. Brill, 2005, "Probabilistic/Mechanistic Modeling of Slug Initiation in a Lower Elbow of a Hilly Terrain Pipeline," Proceedings of 12th International Conference on Multiphase Technology, Barcelona, Spain, May 25-27, 2005.
13. **H.-Q. Zhang**, Q. Wang, C. Sarica, and J.P. Brill, 2004, "Unified Model of Heat Transfer in Gas-Liquid Pipe Flow," SPE 90459, ATCE, September 26-30, 2004, Houston, TX.
14. R. Manabe, Q. Wang, **H.-Q. Zhang**, C. Sarica and J.P. Brill, 2004, "A Mechanistic Heat Transfer Model for Horizontal Two-Phase Flow," BHR Group 4th North American Conference on Multiphase Technology, June 3-4, 2004, Banff, Canada.
15. Y. Fan, Q. Wang, **H.-Q. Zhang** and C. Sarica, 2004, "Experimental Study of Air-Water and Air-Oil Low Liquid Loading Horizontal Two-Phase Flow in Pipes," BHR Group 4th North American Conference on Multiphase Technology, June 3-4, 2004, Banff, Canada.

16. E.M. Al-Safran, C. Sarica, **H.-Q. Zhang** and J.P. Brill, 2003, "Probabilistic/Mechanistic Modeling of Slug Length Distribution in a Horizontal Pipeline," SPE84230, ATCE, October 5-8, 2003, Denver, CO.
17. R. Manabe, Q. Wang, **H.-Q. Zhang**, C. Sarica and J.P. Brill, 2003, "A Mechanistic Heat Transfer Model for Vertical Two-Phase Flow," SPE 84226, ATCE, October 5-8, 2003, Denver, CO.
18. **H.-Q. Zhang**, Q. Wang, C. Sarica and J.P. Brill, 2002, "Slug Characteristics and Flow Pattern Transition," BHR Group 3rd North American Conference on Multiphase Technology, June 6-7, 2002, Banff, Canada.
19. R. Manabe, **H.-Q. Zhang**, E. Delle-Casse, J.P. Brill, 2001, "Crude Oil-Natural Gas Two-Phase Flow Pattern Transition Boundaries at High Pressure Conditions," SPE 71563, ATCE, Sept. 30 – Oct. 3, 2001, New Orleans, LA.
20. A. Matzain, A.S. Apte, **H.-Q. Zhang**, M. Volk, C.L. Redus, J.P. Brill and J.L. Creek, 2001, "Multiphase Flow Wax Deposition Modeling," Proceedings of ASME ETCE Petroleum Production Technology Symposium, February 5-7, 2001, Houston, TX.
21. E.A. Al-Safran, J.P. Brill, S. Jayawardena, **H.-Q. Zhang** and C.L. Redus, 2000, "An Experimental Study of Two-Phase Flow in a Hilly-Terrain Pipeline," Proceedings of ASME ETCE, February 14-17, 2000, New Orleans, LA.
22. H. Yuan, C. Sarica, **H.-Q. Zhang**, J.P. Brill, 1999, "Characterization of Slug Dissipation in Downward Flow," BHR Group 9th International Conference – Multiphase 99, June 16-18, 1999, Cannes, France.
23. **H.-Q. Zhang**, 1998, "Effect of splitter plate on the transition of the cylinder wake," **AIAA 98-0780**, 36th Aerospace Sciences Meeting and Exhibit, January 12-15, 1998, Reno, NV.
24. **H.-Q. Zhang**, 1997, "Origin of Streamwise Vortices in the Cylinder Wake," **AIAA 97-0078**, 35th Aerospace Sciences Meeting and Exhibit, January 6-10, 1997, Reno, NV.
25. U. Dallmann, Th. Herberg, H. Gebing, W.-H. Su and **H.-Q. Zhang**, 1995, "Flow Field Diagnostics: Topological Flow Changes and Spatio-Temporal Flow Structure," **AIAA 95-0791**, 33rd Aerospace Sciences Meeting and Exhibit, January 9-12, 1995, Reno, NV.
26. U. Dallmann, W.-H. Su and **H.-Q. Zhang**, 1995, "Three-Dimensional Separated Flows around Prolate Spheroids – Numerical Simulations versus Experimental Investigations," First Asian Computational Fluid Dynamics Conference, January 16-19, 1995, Hong Kong, p.1103.

Technical Reports

1. **H.-Q. Zhang**, B.R. Noack, H. Eckelmann, 1994, "Numerical Computation of the 3-D Cylinder Wake," Bericht 3/1994, Max-Planck-Institut für Strömungsforschung, Göttingen, ISSN 0436-1199.
2. **H.-Q. Zhang**, B.R. Noack, H. Eckelmann, 1994, "On Centrifugal Instabilities in Time-Dependent Flows with Axisymmetric Boundary Conditions," Bericht 19/1994, Max-Planck-Institut für Strömungsforschung, Göttingen, ISSN 0436-1199.

Thesis and Dissertation

1. **H.-Q. Zhang**, 1988, "Numerical Simulation and Experimental Investigation of Large Scale Coherent Structures in Free Shear Layers," Ph.D. Dissertation, Department of Mechanics, Tianjin University, Tianjin, China.
2. **H.-Q. Zhang**, 1985, "Experimental Study of Two-Phase Flow and Drag Characteristics in the Tip of a Bayonet Tube," M.S. Thesis, Department of Thermal Energy Engineering, Xi'an Jiaotong University, Xian, China.

Patents

1. **H.-Q. Zhang**: “A Hydraulic Self Suppression Safety Controller for Low Pressure Boiler,” Doc. No. 46779, Dec. 7, 1989, China.
2. **H.-Q. Zhang** and P.-S. Li: “A Single Grate Boiler and Smoke Elimination with Combined Method,” Doc. No. 54700, June 22, 1990, China.
3. **H.-Q. Zhang**, J.P. Brill and C. Sarica: “Extracting Gas Hydrates from Marine Sediments,” US Patent 7,546,880 B2, June 2009.

Presentations

1. “Water Quest,” JTU Alumni Reunion, June 18-20, 2010, Houston, TX.
2. “Approaches to Wax Deposition Modeling under Multiphase Flow Conditions,” AIChE 2002 Spring National Meeting, March 11-13, 2002, New Orleans, LA.
3. “Flow Pattern Transition Based on Slug Dynamics,” Tulsa University Petroleum Engineering Graduate Seminar, March 2002.
4. “Unified Modeling of Gas-Liquid Pipe Flow via Slug Dynamics,” Poster Presentation, SPE Forum “Multiphase Capabilities in Frontier Environments,” Sainte Maxime, France, September 2003.
5. “Wax Deposition Modeling Under Multiphase Flow Conditions,” Poster Presentation, SPE Forum “Multiphase Capabilities in Frontier Environments,” Sainte Maxime, France, September 2003.
6. “Discussions on Emulsions,” Leading Discussion, SPE Forum “Multiphase Capabilities in Frontier Environments,” Sainte Maxime, France, September 2003.

Research Projects

1. Director, Tulsa University Artificial Lift Projects (TUALP), Research Consortium Funded by Several Oil and Equipment Companies. Budget about: \$350,000/Year. From May 2012.
2. Director, Tulsa University High-viscosity Oil Projects (TUHOP), JIP Funded by Chevron and Other Oil Companies. Fund Expected: \$500,000/Year. Ongoing.
3. Associate Director, Tulsa University Fluid Flow Projects (TUFFP), Research Consortium Funded by 16 Oil and Gas Companies, Various Projects on Multiphase Flow in Wells and Pipelines, Budget about \$750,000/Year. 2003-2012.
4. PI, “Droplet Dynamics in Multiphase Flow” Funded by Chevron TUCoRE. Fund Received from 2006 to 2008: \$144,000. Completed.
5. PI, “Pressure Wave Propagation Technique for Flowline Blockage Detection” Funded by Shell International. Fund received in 2004 and 2005: \$120,796. Completed.
6. PI, “Measurements of 3-D Multiphase Flow Structures Using NMR” Funded by Chevron TUCoRE. Fund received in 2004 and 2005: \$74,000. Completed.
7. PI, “Optimization of Corrosion Inhibitor Injection in Flowlines” Funded by Chevron TUCoRE. Fund received in 2006 and 2007: \$90,000. Completed.
8. PI, “Preventing Hydrate Reformation in Wellbore” Funded by Chevron TUCoRE. Fund Received in 2007: \$50,000. Completed.
9. Co-PI, “Development of Next Generation Multiphase Pipe Flow Prediction Tools,” Funded by DOE. Budget of \$731,995 over Five Years from 2003 to 2008. Completed.
10. PI, “Slug Tracking Modeling in Gas-Liquid Pipe Flow,” Research Project for Texaco, Fund Received in 2000: \$19,460. Completed.

Professional Service Activities

- ABET Review Coordinator, 2012
- Associate Editor, SPE Journal, from 2007
- Associate Editor, ASME JERT, from 2011
- Chairman of Undergraduate Curriculum Committee, 2011-2012
- Graduate Advisor, Department of Petroleum Engineering, The University of Tulsa, 2006-2009
- Coordinator of Graduate Seminar, Department of Petroleum Engineering, The University of Tulsa, 2003-2006
- Reviewer for Journals, including International Journal of Multiphase Flow, SPE Journals, Journal of Petroleum Science and Engineering, ASME J. Energy Resources Technology, Computer Methods in Applied Mechanics and Engineering, J. Applied Mathematics and Physics, Asian-Pacific Journal of Chemical Engineering
- Discussion Leader on Emulsion, SPE Forum “Multiphase Capabilities in Frontier Environments,” Sainte Maxime, France, September 2003
- Symposium Session Co-Chair, ASME ETCE2000 Petroleum Production Technology Symposium, New Orleans, February 2000
- Deputy Chair of Department of Mechanics, Tianjin University, 1996-1998
- Vice Board Chairman of the Seventh Council of Tianjin Society of Mechanics, 1997

Civic Activities

- Tulsa University Internationalization Laboratory Steering Committee member, 2009-2011
- Senator of the University of Tulsa, 2004-2005
- Trustee and Ministry Team Leader, Agape Chinese Baptist Church, Broken Arrow
- Committee Member, Chinese American Association Tulsa, 2002-2004