

CURRICULUM VITAE

YUMING LIU

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Cambridge, Massachusetts 02139
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EDUCATION

Ph.D. in Hydrodynamics, M.I.T., 1994. Theoretical and computational wave hydrodynamics.

S.M. in Coastal Engineering, University of Florida, 1988. Estuary dynamics and sediment transport.

S.B. in Civil Engineering, Hohai University, Nanjing, China, 1985. Structural mechanics and coastal engineering.

RESEARCH EXPERIENCE

**Principal research scientist and lecturer (7/99 -- present); Research scientist (1/96 -- 6/99)
Department of Mechanical Engineering, MIT**

- (1) Design and analysis of ships and marine structures: Development and application of novel fully-nonlinear hydrodynamics prediction capabilities for the design of advanced vehicles and offshore/marine structures including modeling and computation of three-dimensional breaking waves, green water motion on deck, impact loads due to steep waves and water entry, strongly-nonlinear wave loads on large floating and submerged bodies, large-amplitude motions of ships/platforms, motion of freely dropping bodies, and mooring and cable dynamics.
- (2) Prediction of ocean environments: Development and application of a new generation of tools for the prediction of large-scale nonlinear ocean surface wave-field evolution including interactions with currents, wind, and bottom topography. Development of advanced algorithms and computational tools for deterministic reconstruction and (short-time) forecasting of realistic ocean waves using phase-resolved nonlinear wave simulations and lidar/radar/satellite sensed wave data. Theoretical and computational modeling of multi-layer fluid dynamics and resonant interactions of surface/internal waves with objects and sandy/muddy ocean bottom. Investigation of ocean optics and modeling of radiance transfer and its interactions with ocean dynamic processes.
- (3) Hydrodynamics of multiphase flow in pipes: Development and application of efficient and effective physics-based simulation capabilities for understanding and reliable prediction of the hydrodynamics and regime transition of various violent multiphase (gas/liquid/solid) flows in pipes.
- (4) Vortical flow dynamics: Theoretical and computational analyses of the kinematics of vortical flows near the ocean surface and the vortical dynamics associated with moving bodies and flapping-foils.

- (5) Application of fluid dynamics to music instrument design: Apply fluid dynamics, structural mechanics, and acoustics to investigate fundamental music acoustics and optimize the design of stringed music instruments.

Postdoctoral associate (6/94 -- 12/95)

Department of Ocean Engineering, MIT

Prediction and analysis of surface-wave patterns above a tethered near-surface body for the detection of underwater objects using remote sensing; and stability analysis of a helical vortex filament under a free surface for the design of propellers and marine structures.

CONSULTANT TO

Advanced Marine Technology (AMT), Cambridge, MA.
ChevronTexaco Corporation, Houston, TX.
ExxonMobil Upstream Research Company, Houston, TX.
ConocoPhillips Inc., Houston, TX
Science Application International Corporation, Annapolis, MD

SELECT PUBLICATIONS IN INTERNATIONAL REFEREED JOURNALS

1. Li, C. & Liu, Y. 2017a Nonlinear resonant waves in the gap between two neighboring ships. *Physics of Fluids* (submitted).
2. Li, C. & Liu, Y. 2017b On the nonlinear solution of an oscillating and translating body near the critical frequency. *Journal of Fluid Mechanics* (submitted).
3. Zhang, W., Liu, Y., Ratilal, P. & Makris, N.C. 2017 Nonlinear acoustics in the presence of an object with sum or difference frequency sensing. *Proc. R. Soc. A* (submitted).
4. Campbell, B. & Liu, Y. 2016 Nonlinear coupling of interfacial instabilities with resonant wave interactions in horizontal two-fluid plane Couette/Poiseuille flows: Numerical and Physical Observations. *Journal of Fluid Mechanics*, **809**: 438-479.
5. Campbell, B. & Liu, Y. 2016 A nonlinear flow-transition criterion for the onset of slugging in horizontal channels and pipes. *Physics of Fluids*, **28**: 082103.
6. Miao, S. & Liu, Y. 2015 Wave pattern in the wake of an arbitrary moving surface pressure disturbance. *Physics of Fluids*, **27**: 122102.
7. Nia, H.T., Jain, A.D., Liu, Y., Alam, M.-R., Barnas, R. & Makris, N.C. 2015 The evolution of air resonance power efficiency in the violin and its ancestors. *Proc. R. Soc. A* **471**: 20140905.
8. Campbell, B. & Liu, Y. 2014 Sub-harmonic resonant wave interactions in the presence of a linear interfacial instability. *Physics of Fluids*, **26**: 082107.
9. Campbell, B. & Liu, Y. 2013 Nonlinear resonant interaction of interfacial waves in horizontal stratified channel flows. *Journal of Fluid Mechanics*, **717**: 612-642.
10. Xiao, W., Liu, Y., Wu, G. & Yue, D.K.P. 2013 Rogue wave occurrence and dynamics by direct simulations of nonlinear wavefield evolution. *Journal of Fluid Mechanics*, **720**: 357-392.

11. Dickey, T. ...Liu, Y., ... 2012 Introduction to special section on recent advances in the study of optical variability in the near-surface and upper ocean. *Journal of Geophysical Research*, Vol 117, C00H20.
12. Yan, H. & Liu, Y. 2011a An efficient high-order boundary element method for nonlinear wave-wave and wave-body interactions. *Journal of Computational Physics* **230**, pp. 402-424.
13. Yan, H. & Liu, Y. 2011b Nonlinear computation of water impact of axisymmetric bodies. *Journal of Ship Research*, Vol. 55, No. 1, pp. 29-44.
14. Alam, M.-R., Liu, Y. and Yue, D.K.P. 2011a Nonlinear wave signature of an oscillating and translating disturbance in two-layer fluid. *Journal of Fluid Mechanics*, **675**: 477–494.
15. Alam, M.-R., Liu, Y. and Yue, D.K.P. 2011b Attenuation of short surface waves by the sea floor via nonlinear sub-harmonic interaction. *Journal of Fluid Mechanics*, **689**: 529–540.
16. Lavos, S., Mei, C. C. & Liu, Y. 2010 Oscillating water column at a coastal corner for wavepower extraction. *Applied Ocean Research*, Vol. 32, No. 3, pp 267-283.
17. Alam, M.-R., Liu, Y. and Yue, D.K.P. 2010 Oblique sub- and super-harmonic Bragg resonance of surface waves by bottom ripples. *Journal of Fluid Mechanics*, **643**: 437-461.
18. Yan, H., Liu, Y., Kominiarczuk, J. & Yue, D.K.P. 2009 Cavity dynamics in water entry at low Froude numbers. *Journal of Fluid Mechanics*, **641**: 441-461.
19. Alam, M.-R., Liu, Y. & Yue, D.K.P. 2009a Bragg resonance of waves in a two-layer fluid propagating over bottom ripples. Part I. Perturbation analysis. *Journal of Fluid Mechanics*, **624**: 191-224.
20. Alam, M.-R., Liu, Y. & Yue, D.K.P. 2009b Bragg resonance of waves in a two-layer fluid propagating over bottom ripples. Part II. Numerical simulation. *Journal of Fluid Mechanics*, **624**: 225-253.
21. Alam, M.-R., Liu, Y. & Yue, D.K.P. 2009c Waves due to an oscillating and translating disturbance in a two-layer density stratified fluid. *Journal of Engineering Mathematics*, **65** (2): 179–201.
22. Zhu, Q., Liu, Y. & Yue, D.K.P. 2008 Resonant interaction of Kelvin ship waves and ambient waves. *Journal of Fluid Mechanics*, **597**: 171-197.
23. Mann, J., Liu, Y., Kim, Y. & Yue, D.K.P. 2007 Deterministic and stochastic predictions of motion dynamics of cylindrical mines falling through water. *IEEE Journal of Ocean Engineering*, No. **32** vol. **1**, 21-33.
24. Zhu, Q., Liu, Y. & Yue, D.K.P. 2006 Dynamics of a three-dimensional oscillating foil near the free surface, *AIAA Journal*., vol. **44** no. **12**, 2997-3009.
25. Wu, G. Liu, Y. & Yue, D.K.P. 2006 A note on stabilizing the Benjamin-Feir instability, *Journal of Fluid Mechanics*, **556**: 45-54.
26. Yan, H., Liu, Y., and Yue, D.K.P. 2006 An efficient computational method for nonlinear three-dimensional wave-wave and wave-body interactions, *Journal of Hydrodynamics*, Ser. B., Vol. **18** (13): 84-88.

27. Zhu, Q., Liu, Y. & Yue, D.K.P. 2003 Three-dimensional instabilities of standing waves. *Journal of Fluid Mechanics* **496**, 213-242.
28. Xue, M., Liu, Y. & Yue, D.K.P. 2001 Computations of fully-nonlinear three-dimensional wave-wave and wave-body interactions --- Part I: Dynamics of three-dimensional steep waves. *Journal of Fluid Mechanics* **438**, 11-39.
29. Liu, Y., Xue, M. & Yue, D.K.P. 2001 Computations of fully-nonlinear three-dimensional wave-wave and wave-body interactions --- Part II: Nonlinear wave force and runup on a body. *Journal of Fluid Mechanics* **438**, 41-66.
30. Liu, Y., Zhu, Q., Yue, D.K.P. 1999 Nonlinear radiated and diffracted waves due to the motions of a submerged circular cylinder. *Journal of Fluid Mechanics* **382**, 263-282.
31. Zhu, Q., Liu, Y., Yue, D.K.P. & Triantafyllou, M. S. 1999 Mechanics of nonlinear short-wave generation by a moored near-surface buoy. *Journal of Fluid Mechanics* **381**, 305-335.
32. Mei, X., Liu, Y. & Yue, D.K.P. 1999 On the impact of two-dimensional bodies. *Journal of Applied Ocean Research* **21**, 1-15.
33. Liu, Y. & Yue, D.K.P. 1998 On generalized Bragg scattering of surface waves by bottom ripples. *Journal of Fluid Mechanics* **356**, 297-356.
34. Tjavaras, A.A., Zhu, Q, Liu, Y., Yue, D.K.P. & Triantafyllou, M. S. 1998 The mechanics of highly-extensible cables. *Journal of Sound and Vibration* **213(4)**, 709-737.
35. Liu, Y. & Yue, D.K.P. 1996 On the time dependence of the wave resistance of a body accelerating from rest. *Journal of Fluid Mechanics* **310**, 337-363.
36. Liu, Y., Yue, D.K.P. & Kim, M.H. 1993 First- and second-order responses of a floating toroidal structure in long-crested irregular seas. *Applied Ocean Research* **15**, 155-167.
37. Liu, Y. & Yue, D.K.P. 1993 On the solution near the critical frequency for an oscillating and translating body in or near a free surface. *Journal of Fluid Mechanics* **254**, 251-266.
38. Liu, Y., Dommermuth, D.G. & Yue, D.K.P. 1992 A high-order spectral method for nonlinear wave-body interactions. *Journal of Fluid Mechanics* **245**, 115-136.

SELECT PUBLICATIONS IN INTERNATIONAL REFEREED SYMPOSIA

1. Cheng, X. & Liu, Y. 2017. Resonant Waves in the Gap Between Two Ships by Fully-Nonlinear Simulation. *Proc. 32th International Workshop on Water Waves and Floating Bodies*, Dalian, China (*accepted*).
2. Meng, S. & Liu, Y. 2016. Instability of Axially-Symmetric Propagating Waves by a Vertically-Oscillating Sphere. *Proc. 31th International Workshop on Water Waves and Floating Bodies*, Plymouth, MI, USA
3. Meng, S. & Liu, Y. 2015. Instability of propagating waves by a vertically oscillating sphere. APS Div. of Fluid Dynamics, Boston, Nov.
4. Miao, S, Hendrickson, K., Liu, Y. & Subramani, H. 2015 Development of multiphase Navier-Stokes simulation capability for turbulent gas flow over laminar liquid for Cartesian grids. APS Div. of Fluid Dynamics, Boston, Nov.

5. Kiara, A., Hendrickson, K. & Liu, Y. 2015 Effects of inclination and vorticity on interfacial flow dynamics in horizontal and inclined pipes. APS Div. of Fluid Dynamics, Boston, Nov.
6. Li, C. & Liu, Y. 2015 Fully-Nonlinear Simulation of the Hydrodynamics of a Floating Body in Surface Waves by a High-Order Boundary Element Method. *34th International Conference on Ocean, Offshore and Arctic Engineering (OMAE 2015)*, St. John's, Newfoundland, Canada
7. Campbell, B., Hendrickson, K., Liu, Y. & Subramani, H. 2014 Direct Numerical Simulation of Interfacial Wave Generation in Turbulent Gas-Liquid Flows in Horizontal Channels. APS Div. of Fluid Dynamics, San Francisco, Nov.
8. Liu, Y. & Yue, D.K.P. 2014 Large-Scale Phase-Resolved Wave-Field Reconstruction and Forecasting, *Proceedings of the DoD HPCMP Users Group Conference 2014*.
9. Campbell, B., Hendrickson, K., Liu, Y. & Subramani, H. 2014 Direct Numerical Simulation of Interfacial Wave Generation in Turbulent Gas-Liquid Flows in Horizontal Channels. APS Div. of Fluid Dynamics, San Francisco, Nov.
10. Campbell, B., Kiara, A., Hendrickson, K., Liu, Y. & Subramani, H. 2013 Multi-Dimensional Modeling of Two-Phase Flows in Channels and Pipelines. *Proceedings of Offshore Technology Conference*, Houston, Texas, USA, 6–9 May 2013.
11. Liu, Y., Xiao, W. & Yue, D.K.P. 2013 Prediction of Rogue Waves in Open Seas by Phase-Resolved Nonlinear Wave-Field Simulations, *Proceedings of the DoD HPCMP Users Group Conference 2013*.
12. Xiao, W., Liu, Y. and Yue, D.K.P. 2012 Prediction of Rogue Waves by Large-Scale Phase-Resolved Nonlinear Wavefield Simulations, *Proceedings of the DoD HPCMP Users Group Conference 2012*, New Orleans, LA.
13. Yan, H., Liu, Y. & Li, Y. 2011 Unstable Motion of a Floating Structure in Surface Waves, *30th International Conference on Offshore Mechanics and Arctic Engineering (OMAE2011)*, June 19-24, 2011, Rotterdam, The Netherlands.
14. Xiao, W., Liu, Y. and Yue, D.K.P. 2011a Nonlinear nearshore wave environment for ship motion. Proceedings of 11th International Conference on Fast Sea Transportation, FAST 2011, Honolulu, Hawaii, USA
15. Xiao, W., Liu, Y. and Yue, D.K.P. 2011b Large-Scale Deterministic Predictions of Nonlinear Ocean Wave-Fields, *Proceedings of the DoD HPCMP Users Group Conference 2011*, June, Portland, OR
16. Tao, A. & Liu, Y. 2010 Rogue Waves Due To Nonlinear Broadband Wave Interactions, *Proc. 25th International Workshop on Water Waves and Floating Bodies*, May 9-12, Harbin, China.
17. Yan, H. & Liu, Y. 2010 Efficient Computations of Fully-Nonlinear Wave Interactions with Floating Structures, *29th International Conference on Offshore Mechanics and Arctic Engineering (OMAE2010)*, June 6-11, 2010, Shanghai, China
18. Liu, Y., Yan, H. & Yung, T.-W. 2010 Nonlinear Resonant Response of Deep Draft Platforms in Surface Waves, *29th International Conference on Offshore Mechanics and Arctic Engineering (OMAE2010)*, June 6-11, 2010, Shanghai, China

19. Hendrickson, K., Campbell, B., Liu, Y. & Roberts, R. 2010 Understanding and Prediction of Hydrodynamics of Multiphase Flow Using CFD, *7th International Conference on Multiphase Flow, ICMF 2010*, Tampa, FL, May 30 -- June 4, 2010
20. Xiao, W., Liu, Y. & Yue, D.K.P. 2010 Large-Scale Deterministic Predictions of Nonlinear Ocean Wave-Fields, *Proceedings of the DoD HPCMP Users Group Conference*, June 14-17, 2010, Schaumburg, IL
21. Campbell, B., Hendrickson, K., Liu, Y. & Roberts, R. 2009 Nonlinear effects on interfacial wave growth into slug flow. *28th International Conference on Offshore Mechanics and Arctic Engineering (OMAE2009)*, May 31- June 5, 2009, Honolulu, Hawaii.
22. Campbell, B., Hendrickson, K., Liu, Y. & Roberts, R. 2009 Growth and nonlinear resonant interactions of interfacial waves in stratified channel flows. *American Institute of Chemical Engineering (AIChE) Conference* in November 2009, Nashville, TN.
23. Liu, Y. & Yue, D.K.P. 2009 Large-Scale Phase-Resolved Simulations of Ocean Surface Waves. *OSB Oceanography in 2025 Workshop*, January, 2009, San Diego.
24. Alam, M.-R., Liu, Y. & Yue, D.K.P. 2009 Higher order resonant interactions of surface waves by undulatory bottom topography. *28th International Conference on Offshore Mechanics and Arctic Engineering (OMAE2009)*, May 31- June 5, 2009, Honolulu, Hawaii.
25. Xiao, W., Liu, Y. & Yue, D.K.P. 2009 Hunting for rogue waves in three-dimensional nonlinear wavefield – a direct simulation based approach. *28th International Conference on Offshore Mechanics and Arctic Engineering (OMAE2009)*, May 31- June 5, 2009, Honolulu, Hawaii.
26. Xiao, W., Henry, L., Liu, Y., Hendrickson, K. & Yue, D.K.P. 2008 Ocean Wave Prediction Using Large-Scale Phase-Resolved Computations. *Proceedings of the DoD HPCMP Users Group Conference*, June, 2008, Seattle, WA.
27. Zhu, X. & Liu, Y. 2008 Deterministic and stochastic prediction of the hydrodynamics of a three-dimensional body falling through water. *27th International Conference on Offshore Mechanics and Arctic Engineering (OMAE2008)*, June 15-20, 2008, Estoril, Portugal.
28. Zhang, S., Weems, K., Lin, W.-M., Yan, H. & Liu, Y. 2008 Application of a quadratic boundary element method to ship hydrodynamic problems. *27th International Conference on Offshore Mechanics and Arctic Engineering (OMAE2008)*, June 15-20, 2008, Estoril, Portugal.
29. Kim, Y., Kim, Y., Liu, Y. & Yue, D.K.P. 2007 On the water entry problem of asymmetric problems. *9th International Conference on Numerical Ship Hydrodynamics*, Ann Arbor, Michigan, August.
30. Wu, G., Liu, Y. & Yue, D.K.P. 2007 Ocean wave prediction using large-scale phase-resolved computations. *DoD HPCMP UGC 2007*, Pittsburgh, PA.
31. Yan, H., Liu, Y. & Yue, D.K.P. 2007 Fully nonlinear computation of water surface impact of axisymmetric bodies. *5th International Conference on Fluid Mechanics*, Shanghai, China, August.

32. Alam, M.-R., Liu, Y. & Yue, D.K.P. 2007 Resonant interaction of waves generated by a moving/oscillating body in a two-layer density stratified fluid. *60th Annual Meeting of the American Physical Society Division of Fluid Dynamics*, Salt Lake City, Utah.
33. Yan, H. & Liu, Y. 2007 Cavity dynamics in vertical water entry of a body at low Froude number. *60th Annual Meeting of the American Physical Society Division of Fluid Dynamics*, Salt Lake City, Utah.
34. Yan, H., Liu, Y. & Yue, D.K.P. 2006 An efficient computational method for nonlinear wave-wave and wave-body interactions. *Proc. of the Conference of Global Chinese Scholars on Hydrodynamics*, Shanghai, China.
35. Wu, G., Liu, Y. & Yue, D.K.P. 2005 Studying rogue waves using large-scale direct phase-resolved simulations, *Proc. 14th 'Aha Huliko'a Winter Workshop, Rogue Waves*, Honolulu, Hawaii.
36. Hover, F., Liu, Y., Triantafyllou, M.S. & Yue, D.K.P. 2005 Optimal maneuvering of vessels in deterministic waves. *Proc. 7th Symposium on High Speed Marine Vehicles*, Naples, Italy.
37. Wu, G., Liu, Y. & Yue, D.K.P. 2004 Dissipation effect on Benjamin-Feir instability of a Stokes wave train. *57th Annual Meeting of the American Physical Society Division of Fluid Dynamics*, Seattle, Washington.
38. Kim, Y., Liu, Y. & Yue, D.K.P. 2002 Motion dynamics of 3D bodies falling through water. *17th Workshop on water wave and floating bodies*, Cambridge, UK.
39. Wu, G., Liu, Y. & Yue, D.K.P. 2000 Numerical reconstruction of nonlinear irregular wave-field using single or multiple probe data. *Proc. 15th International Workshop on Water Waves and Floating Bodies*, Israel.
40. Zhu, Q., Liu, Y. & Yue, D.K.P. 1997 Resonant interactions of Kelvin ship waves and ambient ocean waves. *Proc. 12th International Workshop on Water Waves and Floating Bodies*, Marseilles, France.
41. Zhu, Q., Liu, Y., Triantafyllou, M.S. & Yue, D.K.P. 1997 Nonlinear short-wave patterns above a near-surface tethered body. *ONR Workshop on Free-Surface and Wall-Bounded Turbulence and Turbulent Flows*, Pasadena, CA.
42. Liu, Y. & Yue, D.K.P. 1994 The transient force history on a body started from rest. *Proc. 9th International Workshop on Water Waves and Floating Bodies*, Kuju, Oita, Japan.
43. Liu, Y. & Yue, D.K.P. 1993a Resonant reflection of surface waves traveling over bottom undulations. *Proc. 8th International Workshop on Water Waves and Floating Bodies*, St. John's, Newfoundland, Canada.
44. Liu, Y., & Yue, D.K.P. 1993b A high-order spectral method for nonlinear wave refraction/diffraction. *Proc. of the 1st SES-ASME-ASCE Joint Meeting: Nearshore Nonlinear Wave Hydrodynamics*, Charlottesville, Virginia.
45. Liu, Y. & Yue, D.K.P. 1992 The nonlinear diffraction forces on a submerged spheroid. *Proc. 7th International Workshop on Water Waves and Floating Bodies*, Val de Reuil, France.

46. Liu, Y. & Yue, D.K.P. 1991 The high-order diffraction forces on a submerge circular cylinder. *Proc. 6th International Workshop on Water Waves and Floating Bodies*, Woods Hole, MA