

CEE Faculty Profile



Philip J. Roberts

Professor

Affinity Group: Environmental Fluid Mechanics and Water Resources

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Dr. Roberts' professional interests are in environmental fluid mechanics, particularly its application to the engineering design of water intakes and ocean outfalls for disposal of wastewaters and desalination brine, and density-stratified flows in lakes, estuaries, and coastal waters. This includes mixing and dynamics of natural water bodies, mathematical modeling of water quality, field studies, and laboratory studies of turbulent mixing.

He is an authority on the fluid mechanics of outfall diffuser mixing and the development and application of mathematical models of wastewater fate and transport. He has extensive international experience in marine wastewater disposal including the design of ocean outfalls, review of disposal schemes, numerical modeling, and the design and analysis of oceanographic field study programs. Dr. Roberts has lectured widely on outfall design and is presently Co-Chairman of the IAHR/IWA Committee on Marine Outfall Systems.

Dr. Roberts' mathematical models and methods have been adopted by the U.S. EPA and are widely used around the world. He is a regular lecturer at workshops for the U.S. EPA on mixing zone analyses and on the use of mathematical models and outfall design for the Pan American Health Organization. He has developed innovative experimental techniques for research on diffuser mixing processes using three-dimensional laser-induced fluorescence and has published extensively in this area. For this research he was awarded the Collingwood Prize of ASCE in 1980 and was UPS Foundation Visiting Professor at Stanford University in 1993-94. He is presently one of only two Distinguished Scholars in the National Ocean and Atmospheric Administration (NOAA) Oceans

and Human Health Initiative (OHHI) in which he is conducting research on the hydrodynamic aspects of bacterial and pathogen transport in coastal waters.

Dr. Roberts holds a professional engineering (PE) license.

Research Interests

- Environmental fluid mechanics, mixing and dynamics of rivers, lakes, coastal waters, and estuaries
- Outfalls for wastewater discharge
- Mathematical models of wastewater fate and transport
- Oceanographic field programs and data interpretation

Education

- Ph.D., Environmental Engineering Science, California Institute of Technology, 1977.
- M.S., Environmental Engineering Science, California Institute of Technology, 1972.
- S.M., Mechanical Engineering, Massachusetts Institute of Technology, 1970.
- B.Sc. (Eng), Mechanical Engineering, First Class Honors, Imperial College of Science and Technology, 1968.

Honors

1. Appointed to and Chairman of "Expert Panel on Fate and Effects of Brine Discharge" State of California Water Resources Control Board, October 2011 -
2. Distinguished Scholar, NOAA Oceans and Human Health Initiative, 2006-2008
3. UPS Foundation Visiting Professor, Stanford University, 1993-94
4. Member of the Hydrologic Transport and Dispersion Committee, ASCE, 1988 to present.
5. Fellow, American Society of Civil Engineers
6. Adjunct Professor of Oceanography, Skidaway Institute of Oceanography, Georgia
7. Associate Editor, Journal of Hydraulic Engineering, 1987 to 1992
8. Chairman of the ASCE Hydraulics Division Research Committee, 1986-1987
9. Co-Chairman, IAHR/IWA Committee on Marine Outfall Systems
10. Registered Professional Engineer number GA 12476, Georgia, United States
11. 1980 Collingwood Prize of ASCE for paper: "Line Plume and Ocean Outfall Dispersion"

Awards

1999-2000 Outstanding Interdisciplinary Activity Award, School of CEE (with Don Webster).

Articles

1. Gandhi, V. N., Roberts, P. J. W., and Kim, J.-H. (2013). "Visualizing and Quantifying Dose Distribution in a UV Reactor Using Three-Dimensional Laser-Induced Fluorescence." ES&T, 46(24), 13220-13226.

2. Nekouee, N., Roberts, P. J. W., Schwab, D. J., and McCormick, M. J. (2013). "Classification of Buoyant River Plumes from Large Aspect Ratio Channels." *J. Hydraul. Eng.*, 139(3), 296-309.
3. Tian, X., and Roberts, P. J. W. (2011). "Experiments on Marine Wastewater Diffusers with Multiport Rosettes." *J. Hydraul. Eng.*, 137(10), 1148-1159.
4. Roberts, P. J. W., Hunt, C. D., Mickelson, M. J., and Tian, X. (2011). "Field and Model Studies of the Boston Outfall." *J. Hydraul. Eng.*, 137(11), 1415-1425.
5. Tian, X., and Roberts, P. J. W. (2011). "Experiments on Marine Wastewater Diffusers with Multiport Rosettes." *J. Hydraul. Eng.*, 137(10), 1148-1159.
6. Roberts, P. J. W., Tian, X., and Jung, Y. (2011). "Physical Model Study of an Alternating Diffuser for Thermal Discharge." *J. Hydraul. Eng.*, 137(9), 1027-1036.
7. Kim, D., Nemlioglu, S., Roberts, P.J.W., and Kim, J.-H. (2010). "Ozone Contactor Flow Visualization and Quantification Using Three-Dimensional Laser-Induced Fluorescence (3DLIF)." *Journal AWWA*, 102(1), 90-99.
8. Kim, D.-i., Elovitz, M., Roberts, P. J. W., and Kim, J.-H. (2010). "Using 3D LIF to investigate and improve performance of a multichamber ozone contactor " *Journal of the American Water Works Association*, 102(10), 61-70.
9. Hunt, C.D., Mansfield, A.D., Mickelson, M.J., Albro, C.S., Geyer, W.R., and Roberts, P.J.W. (2010). "Plume tracking and dilution of effluent from the Boston sewage outfall" *Marine Environmental Research*, 70(2), 150-161.
10. Gungor, E., and Roberts, P.J.W. (2009). "Experimental Studies on Vertical Dense Jets in a Flowing Current." *J. Hydraul. Eng.*, 135(11), 935-948.
11. Tian, X., and Roberts, P.J.W. (2008). "Mixing in Water Storage Tanks II: With Buoyancy Effects." *J. Env. Eng.*, 134(12), 986-995.
12. Tian, X., and Roberts, P.J.W. (2008). "Mixing in Water Storage Tanks I: No Buoyancy Effects." *J. Env. Eng.*, 134(12), 974-985.
13. Carvalho, J.L.B., Feitosa, R.C., Rosman, P.C.C., and Roberts, P.J.W. (2006). "A Bacterial Decay Model for Coastal Outfall Plumes." *Journal of Coastal Research*, Special Issue 39, 1524-1528.
14. Tian, X., Roberts, P.J.W., and Daviero, G.J. (2006). "Marine Wastewater Discharges from Multiport Diffusers IV: Stratified Flowing Water." *Journal of Hydraulic Engineering*, 132(4), 411-419.
15. Daviero, G.J., and Roberts, P.J.W. (2006). "Marine Wastewater Discharges from Multiport Diffusers III: Stratified Stationary Water." *Journal of Hydraulic Engineering*, 132(4), 404-410.
16. Tian, X., Roberts, P.J.W., and Daviero, G.J. (2004b). "Marine Wastewater Discharges from Multiport Diffusers II: Unstratified Flowing Water." *Journal of Hydraulic Engineering*, 130(12), 1147-1155.
17. Tian, X., Roberts, P.J.W., and Daviero, G.J. (2004a). "Marine Wastewater Discharges from Multiport Diffusers I: Unstratified Stationary Water." *Journal of Hydraulic Engineering*, 130(12), 1137-1146.
18. Roberts, P.J.W., and Tian, X. (2004). "New Experimental Techniques for Validation of Marine Discharge Models." *Environmental Modelling & Software*, 19 (7-8), 691-699.
19. Tian, X., and Roberts, P.J.W. (2003). "A 3D LIF System for Turbulent Buoyant Jet Flows." *Experiments in Fluids*, 35, 636-647.

20. Webster, D. R., Roberts, P.J.W., and Ra'ad, L. (2001). "Simultaneous DPTV/PLIF Measurements of a Turbulent Jet." *Experiments in Fluids*, 30, 65-72.
21. Roberts, P.J.W., Maile, K., and Daviero, G.J. (2001). "Mixing in Stratified Jets." *Journal of Hydraulic Engineering*, ASCE, 127 (3).
22. Daviero, G.J., Roberts, P.J.W., and Maile, K. (2001). "Refractive Index Matching in Large-Scale Stratified Experiments." *Experiments in Fluids*, 31, 119-126.
23. Carvalho, J.L.B., Roberts, P.J.W., and Roldao, J. (2001). "Field observations of the Ipanema beach outfall." *Journal of Hydraulic Engineering*, ASCE, 128 (2), 151-160.
24. Roberts, P.J.W. (1999b). "Modeling the Mamala Bay Plumes. II: Far field." *Journal of Hydraulic Engineering*, ASCE, 125 (6), 574-583.
25. Roberts, P.J.W. (1999a). "Modeling the Mamala Bay Plumes. I: Near field." *Journal of Hydraulic Engineering*, ASCE, 125 (6), 564-573.
26. Roberts, P.J.W., and Sternau, R.F. (1997). "Mixing Zone Analysis for a Coastal Wastewater Discharge." *Journal of Environmental Engineering*, ASCE, 123(12), 1244-1250.
27. Roberts, P.J.W., Ferrier, A., and Daviero, G. (1997). "Mixing in Inclined Dense Jets." *Journal of Hydraulic Engineering*, ASCE, 123(8), 693-699.
28. Ferrier, A., Funk, D., and Roberts, P.J.W. (1993). "Application of Optical Techniques to the Study of Plumes in Stratified Fluids." *Dynamics of Atmospheres and Oceans*, 20, 155-183.
29. Roberts, P.J.W., and Snyder, W.H. (1993b). "Hydraulic Model Study for the Boston Outfall. II: Environmental Performance." *Journal of Hydraulic Engineering*, ASCE, 119 (9), 988-1002.
30. Roberts, P.J.W., and Snyder, W.H. (1993a). "Hydraulic Model Study for the Boston Outfall. I: Riser Configuration." *Journal of Hydraulic Engineering*, ASCE, 119 (9), 970-987.
31. Roberts, P.J.W., Snyder, W.H., and Baumgartner, D.J. (1989c). "Ocean Outfalls. III: Effect of Diffuser Design On Submerged Wastefield." *Journal of Hydraulic Engineering*, ASCE, 115 (1), 49-70.
32. Roberts, P.J.W., Snyder, W.H., and Baumgartner, D.J. (1989b). "Ocean Outfalls. II: Spatial Evolution of Submerged Wastefield." *Journal of Hydraulic Engineering*, ASCE, 115 (1), 26-48.
33. Roberts, P.J.W., Snyder, W.H., and Baumgartner, D.J. (1989a). "Ocean Outfalls. I: Submerged Wastefield Formation." *Journal of Hydraulic Engineering*, ASCE, 115(1), 1-25.

Books

1. Abessi, O. and Roberts, P. (2014). "Multiport Diffusers for Dense Discharges." *J. Hydraul. Eng.*, 10.1061/(ASCE)HY.1943-7900.0000882 , 04014032.
2. Roberts, P.J.W. (2013). "Ocean Outfalls." In *Handbook of Environmental Fluid Dynamics*, Volume Two. H. J. Fernando, Ed., CRC Press: 229-242.
3. Roberts, P.J.W. et al. (2010). "Marine Wastewater Outfalls and Treatment Systems." International Water Association, London.
4. Roberts, P.J.W., and Webster, D.R. (2002). "Turbulent Diffusion," in *Environmental Fluid Mechanics - Theories and Applications*, H. Shen, Ed., ASCE, Reston, Va.
5. Ettema, R., Arndt, R., Roberts, P.J.W., and Wahl, T. (2000). *Hydraulic Modeling: Concepts and Practice*, ASCE, Reston, Virginia.
6. Roberts, P.J.W. (1996). "Sea Outfalls," in "Environmental Hydraulics," V. P. Singh and W. Hager, eds., Kluwer Academic Publishers, Dordrecht.

7. Roberts, P.J.W. "Ocean Outfalls," in *Critical Reviews in Environmental Control*, Conrad P. Straub, Ed., Volume 20, Issues 5,6, CRC Press, Inc., 1991.
8. Roberts, P.J.W. "Ocean Outfall Design Considerations," in *Ocean Engineering Science: The Sea*, Volume 9, B. Le Mehaute and D. M. Haines, Eds., John Wiley and Sons, 1990.
9. Roberts, P.J.W. "Mixing and Transport in Natural Streams," in *Encyclopedia of Fluid Mechanics*, Volume 10, N. P. Cheremisinoff, Ed., Gulf Publishing, 1990.

Presentations

1. Roberts, P.J.W. (2014). "Topics in Environmental Hydraulics," Keynote presentation at 7th International Symposium on Environmental Hydraulics, ISEH2014, Nanyang Technological University, Singapore, January 7 – 11, 2014.
2. Roberts, P.J.W. (2014). " Methods of Brine Disposal from Seawater Desalination," Keynote presentation at International Conference on “Desalination, Environment And Marine Outfall Systems” to be held from 13-16 April 2014 at Sultan Qaboos University (SQU), Muscat, Oman.
3. Roberts, P.J.W. (2013). "Mixing of Brine Discharges," Keynote address at the Workshop “Seawater Intakes and Desalination Brine/Wastewater Outfalls: Coastal Environmental Impacts in the Gulf Collaboration Region.” King Abdullah University of Science and Technology (KAUST), Saudi Arabia, October 6 – 9, 2013.
4. Nemlioglu, S., and Roberts, P. J. W. (2011). "Three Dimensional Analyses of Inclined Dense Jets under Counter and Co-flow Conditions." International Symposium on Outfall Systems, Mar del Plata, Argentina May 15-18, 2011, IWA.
5. Roberts, P.J.W. (2010). "Issues in Marine Wastewater Disposal." 44th Annual Congress, Ottawa, Canada, May 31 - June 4, 2010, Canadian Meteorological and Oceanographic Society.
6. Frick, W., Ahmed, A., George, K., Laputz, A., Pelletie, G., and Roberts, P. (2010). "On Visual Plumes and associated applications." MWW2010 6th International Conference on Marine Waste Water Discharges and Coastal Environment, C. Avanzini, ed. Langkawi, Malaysia.
7. Roberts, P. J. W., Villegas, B., and Libhaber, M. (2010). "Modelling urbanization effects on Lake Titicaca." Linking Ecosystem-based Science to Management in the Great Lakes of the World, Lake Tahoe, California, June 13 - 17, 2010.
8. Gandhi, V.; Cho, M.; Kim, D. J.; Kim, D.; Wright, H.; Lee, K. H. Roberts, P.; Stoesser, T.; Kim, J. H. (2008). “UV Process Flow Visualization and Characterization Using 3-Dimensional Laser Induced Fluorescence.” American Water Works Association Annual Conference and Exposition, Atlanta, GA
9. Nekouee, N., Roberts, P.J.W., and Schwab, D.J. (2008). "Far Field Prediction of the Grand River Plume." 12th International Workshop on Physical Processes in Natural Waters (PPNW), UC Davis Tahoe Environmental Research Center, Incline Village, Nevada, September 2 - 5, 2008
10. Roberts, P.J.W. (2007). "Wastewater Outfalls for Industrial Marine Discharges." EnviroArabia 2007, Bahrain, April 23-25, 2007.
11. Roberts, P.J.W. (2005). "Examples of New Instrumentation for Studying Turbulent Mixing." Heleco '05, Athens, Greece, Feb. 3-6, 2005.

12. Roberts, P.J.W. (2003). "Recent Developments in Marine Wastewater Discharge Technology." Heleco '03, Athens, Greece, Jan. 29-Feb. 1, 2003.
13. Roberts, P.J.W. (2001). "Turbulent Jets and Plumes Applied to Ocean Outfalls." Invited Keynote Address, Third International Environmental Hydraulics Symposium, Tempe, Arizona, December 5-8, 2001.
14. Roberts, P.J.W. (1993). "Fluid Mechanics Aspects of Ocean Outfalls," National Conference on Hydraulic Engineering, San Francisco, July 25-30, 1993.
15. Roberts, P.J.W. (1993). "Jets and Plumes and Ocean Outfall Design," NATO Advanced Research Workshop on Turbulent Jets and Plumes, Portugal, June 28-July 2.
16. Roberts, P.J.W. (1992). "New Instrumentation for Stratified Flow Experiments," Institute of Mathematics and Its Applications, Fourth Conference on Stably Stratified Flows, Surrey, England, September 21-23.
17. Roberts, P.J.W. (1992). "Modeling Ocean Outfalls," Plenary Speaker, National Heat Transfer Conference, ASME, San Diego, August 8-12.
18. Roberts, P.J.W. and Williams, N. (1991), "Modeling of Ocean Outfall Discharges," IAWPRC International Conference on Marine Disposal Systems, Lisbon, Portugal, 20-22 November.