Exponent®
Engineering & Scientific Consulting

Harry Watson, Ph.D.

Managing Engineer | Thermal Sciences
Natick
+1-508-652-8514 | watsonh@exponent.com

Professional Profile

Dr. Watson is a chemical engineer in Exponent's Thermal Sciences Practice consulting primarily in the areas of oil and gas processing, process safety and risk analysis, and advanced thermal fluid analysis. He specializes process modeling, simulation, and optimization of chemical engineering systems.

During his time at Exponent, Dr. Watson has performed dynamic simulations of refinery distillation units and heat exchangers, used multivariate statistical analysis techniques to identify potential foaming precursors in separation systems, and built hydrodynamic models of floating structures for use in large-scale computational fluid dynamics simulations. He has extensive experience modeling heat transfer and phase changes in industrial processes, including cryogenic processes such as mixed-refrigerant liquefaction and air separation, and in the implementation of many state-of-the-art numerical methods for sensitivity analysis, equation solving, and local and global optimization.

Prior to joining Exponent, Dr. Watson performed his Ph.D. research at MIT, which focused on the development of robust models and flowsheeting methods for natural gas liquefaction processes using cutting-edge numerical analysis techniques. Within this area, he made significant advances in reliable methods for modeling phase regime transitions in process equipment, calculating fluid properties from equations of state, and enforcing feasible heat transfer in multistream heat exchangers.

Academic Credentials & Professional Honors

Ph.D., Chemical Engineering, Massachusetts Institute of Technology (MIT), 2018

M.S., Chemical Engineering, Massachusetts Institute of Technology (MIT), 2014

B.Eng., Chemical and Biomolecular Engineering, Vanderbilt University, 2012

Licenses and Certifications

Professional Engineer Chemical, California, #7250

Professional Affiliations

American Institute of Chemical Engineers—AIChE (Member)

National Association of Fire Investigators—NAFI (Member)

National Fire Protection Association—NFPA (Member)

Publications

Watson HAJ, Vikse M, Gundersen T, Barton PI. In Press. Optimization of single mixed-refrigerant natural gas liquefaction processes described by nondifferentiable models. Energy.

Vikse M, Watson HAJ, Gundersen T, Barton PI. In Press. A versatile simulation method for complex single mixed-refrigerant natural gas liquefaction processes. Industrial & Engineering Chemistry Research.

Barton PI, Khan KA, Stechlinski P, Watson HAJ. In Press. Computationally relevant generalized derivatives: theory, evaluation and applications. Optimization Methods and Software.

Watson HAJ, Barton PI. Reliable flash calculations: Part 3. A nonsmooth approach to density extrapolation and pseudoproperty evaluation. Industrial & Engineering Chemistry Research 2017; 56(50):14832-14847.

Watson HAJ, Vikse M, Gundersen T, Barton PI. Reliable flash calculations: Part 2. Process flowsheeting with nonsmooth models and generalized derivatives. Industrial & Engineering Chemistry Research 2017; 56(50):14848-14864.

Watson HAJ, Vikse M, Gundersen T, Barton PI. Reliable flash calculations: Part 1. Nonsmooth inside-out algorithms. Industrial & Engineering Chemistry Research 2017; 56(4):960-973.

Khan KA, Watson HAJ, Barton PI. Differentiable McCormick relaxations. Journal of Global Optimization 2017; 67(4):687-729.

Watson HAJ, Barton PI. Modeling phase changes in multistream heat exchangers. International Journal of Heat and Mass Transfer 2017; 105:207-219.

Sahlodin AM, Watson HAJ, Barton PI. Nonsmooth model for dynamic simulation of phase changes. AIChE Journal 2016; 62(9):3334-3351.

Watson HAJ, Khan KA, Barton PI. Multistream heat exchanger modeling and design. AIChE Journal 2015; 61(10):3390-3403.

Wechsung A, Scott JK, Watson HAJ, Barton PI. Reverse propagation of McCormick relaxations. Journal of Global Optimization 2015; 63(1):1-36.

Presentations

Watson HAJ, Vikse M, Gundersen T, Barton PI. Robust process flowsheeting through nonsmooth models and generalized derivatives. 2017 AIChE Annual Meeting, Minneapolis, MN, Oct. 29 - Nov. 3, 2017.

Watson HAJ, Vikse M, Gundersen T, Barton PI. Robust and efficient flash calculations through nonsmooth inside-out algorithms. 27th European Symposium on Computer-Aided Process Engineering (ESCAPE 27), Barcelona, Spain, Oct. 1 - 5, 2017.

Watson HAJ, Vikse M, Kim D, Gundersen T, Barton PI. A nonsmooth inside-out algorithm for robust flash calculations. 2016 AIChE Annual Meeting, San Francisco, CA, Nov. 13 - 18, 2016.

Watson HAJ, Vikse M, Kim D, Gundersen T, Barton PI. Modeling and simulation of phase change and nonideality in multistream heat exchangers. 26th European Symposium on Computer-Aided Process Engineering (ESCAPE 26), Portorož, Slovenia, June 12 - 15, 2016.

Watson HAJ, Barton PI. Simulation and design methods for multiphase multistream heat exchangers. 11th Symposium on Dynamics and Control of Process and Bioprocess Systems (DYCOPS-CAB 11), Trondheim, Norway, June 6 - 8, 2016.

Watson HAJ, Vikse M, Kim D, Gundersen T, Barton PI. Accurate simulation of natural gas liquefaction processes. 2015 AIChE Annual Meeting, Salt Lake City, UT, Nov. 8 - 13, 2015

Watson HAJ, Khan KA, Barton PI. Multistream heat exchanger modeling and design. 2015 AIChE Annual Meeting, Salt Lake City, UT, Nov. 8 - 13, 2015.

Watson HAJ, Wechsung A, Stuber M, Barton PI. Global Optimization of Implicit Functions. 2014 AIChE Annual Meeting, Atlanta, GA, Nov. 16 - 21, 2014.