

Philip H. Harding, Ph.D., P.E.

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## EDUCATION

[University of Washington, Chemical Engineering Dept.](#)

*Ph.D. Chemical Engineering* 1997: "The Energetics of Adhesion in Composite Materials"

Experimental and theoretical investigation into the relationship between surface energetics and adhesion

[Institute of Paper Science and Technology \(IPST\)](#)

*M.S. Paper Science and Technology* 1992: "Air Knife Flow Visualization"

[Oregon State University, Chemical Engineering Dept.](#)

*B.S. Chemical Engineering* 1987

## EXPERTISE

Project management fundamentals, system analysis and integration, capillary and wetting phenomena, surface characterization, failure mode physics, reliability statistics/engineering/forecasting, transport phenomena/modeling, paper science and manufacturing

## EMPLOYMENT

[Analytical Solutions Consulting, LLC](#) - Corvallis, OR, Jun 2013 - present

*Independent Consulting in Chemical Engineering*

This low-level activity consists of design, intellectual property evaluation, failure analysis, and reliability consulting in chemical engineering applications. Focus is on the use of first principles to reduce design costs and accelerate product development.

[Oregon State University](#) - Corvallis, OR, Sep 2007 - present

*Associate School Head and Linus Pauling Chair in School of Chemical, Biological, and Environmental Engineering*

This endowed professional faculty position has emphasis on preparing engineering students for workforce and professional endeavors. Responsibilities include teaching and organization of capstone senior lab courses across three disciplines, laboratory equipment development, and working with industrial partners to identify and fund senior projects. Teaching responsibilities also include a cross-discipline lab course designed to reinforce transport phenomena fundamentals.

[Hewlett-Packard Company](#) - Corvallis, OR, Oct 1997 – Sep 2007

*Technology Strategist (Master Level Engineer), 2006-2007*

**Manufacturing:** Led assessment and strategy development for worldwide inkjet printhead and ink supply manufacturing, including interaction between R&D and manufacturing sites, understanding funding models, and influencing management. Responsibilities included evaluation of new technology opportunities and business adjacencies.

*Technical Lead (Expert Level Engineer), 2001-2006:*

**Microfluidic Sensing Applications:** Technical team leadership and development of a low-cost, microfluidic platform for multi-step flow sequencing; Platform development included microfluidic design, prototyping, system integration, and testing; Activities in fluidic modeling, chemical reaction engineering, liquid and air management, mechanical design, and optical detection system capability.

**Printed Electronics:** Technical team leadership focused on creating low-cost electronics using additive processes such as inkjet printing to pattern conductors, resistors, dielectrics, and transistors; System modeling responsibilities for display applications to determine process and material set readiness and requirements; Analytical models for material deposition and liquid film stabilities and development of a drop-substrate interaction monitor for high-speed image capture of microscopic phenomena.

**Fuel Cells:** Technical team leadership for development SOFC power generation system with fuel/air delivery, thermal packaging, and instrumentation; System modeling for fuel cell technology comparisons including system (customer) requirements in performance and device size and integrating team contributions to make design tradeoffs and analyses; Mass and energy modeling for various fuel cell technologies, including sodium borohydride and direct methanol.

*Reliability Engineer (Specialist Level Engineer), 1997-2001:*

Developed web-based tool for integrated reliability forecasting, a task requiring negotiation and communication with experienced engineers world-wide. Tool capabilities included multi-failure mode statistics, computation of consumables production requirements based on printer sales, and forecasted reliability. Reliability engineering work relating in-house product and component testing to customer experience through accelerated testing and failure physics characterization; Results included product design changes, modification of thin film surface and use of coupling agents to promote adhesion, and thin film design for stress and bubble reduction.

James River Corp. (now [Georgia-Pacific Corp.](#)) – Various sites, Jul 1987 – Aug 1992

*Process and Process Control Engineering:* Projects included justification and design of wood chip handling and screening system, continuous digester level control, optimization of paper machine additives, implementation of statistical process control to process unit operations.

Chevron Corp. – Richmond, CA, Summers 1984, 1985

## AWARDS/ACTIVITIES

- Loyd Carter Award for outstanding and inspirational teaching, College of Engineering (2015)
- Advisor: oregonclimate.org (2015-present)
- Johnson Hall Building Committee (2013-present)
- Gleeson Hall Building Re-Allocation Committee (2014-present)
- OSU Repair Fair Volunteer (2012-present)
- Advisory Board Member: Oregon State University Writing Intensive Curriculum (2012-present)
- CBEE Curriculum Committee Member (2010-present)
- ASEE Conference CHE Division J.J. Martin Award for Best Paper 2011
- L.L. Steward Faculty Development Award 2011
- Summer Experience in Science and Engineering for Youths (SESEY) Mentor 2009
- Most Inspirational Professor (voted by graduating CBEE seniors) 2009
- Hewlett-Packard Oregon State University ChE Industrial Advisory Panel 2007
- Intel Northwest Science Expo Judge 2006
- Three eAwards from Hewlett-Packard (2004-2007)
- Nine STAR stock option awards from Hewlett-Packard (1998-2007)

- American Institute of Chemical Engineer (AIChE) Member
- Guest lecturer for OSU ChE “Advanced Topics in Polymer Physical Chemistry” 2001
- Professional Engineer certifications: State of Washington since 1997 (#33897), State of Oregon since 2007 (#46013PE)
- President of A.C.E.S. Graduate Student Organization 1996-97
- Visiting Scientist, 1994: Swiss Federal Institute of Technology
- 1993-94 McCarthy Prize for Excellence as a Teaching Assistant
- 1992 IPST Annual Alumni Award for Academic Achievement
- 1982 Mabel Norman Albright 4-year tuition scholarship

#### U.S. PATENTS (15 granted)

- “Fluid-Jet Precision-Dispensing Device Having One or More Holes for Passing Gaseous Bubbles, Sludge, and/or Contaminants During Priming” 9,126,411
- “Method of Detecting Analytes in a Microfluidic Sample and a System for Performing the Same” 8,058,079
- “Microfluidic Centrifugation Systems” 7,935,318
- “System for Optically Analyzing a Substance with a Selected Single-Wavelength” 7,791,728
- “Micro-Mixing Assembly” 7,731,910
- “Air Management in a Fluid Ejection Device” 7,625,080
- “Integrated Fuel Container and Impurity Removal Cartridge” 7,419,060
- “Method of Detecting Analytes in a Microfluidic Sample and a System for Performing the Same” US 7,384,798
- “Method and System for Dispensing Pelletized Fuel for Use with a Fuel Cell” US 7,128,997
- “Fuel Cell Reactant Supply” US 7,122,257
- “Regulator and Method of Regulating Fuel Flow to a Fuel Cell by Adsorption” US 7,052,788
- “Hydrogen Generation Cartridge and Portable Hydrogen Generator” US 7,052,658
- “Fluid Ejection Device Having a Layer with a Discontinuity” US 7,024,768
- “Layer With Discontinuity Over Fluid Slot” US 6,527,368
- "Method and Apparatus To Inhibit Bubble Formation In a Fluid" US 6,458,526

#### PUBLICATIONS AND CONFERENCE PROCEEDINGS

- “Characterization of Student Model Development in Physical and Virtual Laboratories” E.J. Nefcy, P.H. Harding, M. Koretsky, *Proceedings of the 2011 American Society for Engineering Education Annual Conference & Exposition*, 2011. (CHE Division Best Paper)
- “Design of a Senior Laboratory Sequence to Guide Students in Multiple Academic Programs Towards Workforce Preparedness” P.H. Harding, M. Koretsky, K.J. Williamson, *Proceedings of the 2011 American Society for Engineering Education Annual Conference & Exposition*, 2011.
- “Comparison of Student Perceptions of Virtual and Physical Laboratories” M.D. Koretsky, C. Kelly, P.H. Harding, and E. Gummer, *Proceedings of the 2009 American Society for Engineering Education Annual Conference & Exposition* (2009).
- “Teaching Experimental Design using Virtual Laboratories: Development, Implementation and Assessment of the Virtual Bioreactor Laboratory,” C. Kelly, E. Gummer, P.H. Harding and M. Koretsky, *Proceedings of the 2008 American Society for Engineering Education Annual Conference & Exposition*, 2008.
- "Direct measurement of residual stress effects on adhesion", P.H. Harding, S. Page, J.C. Berg, J.-A. Manson, *J. Adhesion Sci. Technol.*, 12, 497, 1998.

- "Identification of a surface phase transition in synthetic calcium hydroxyapatite using inverse gas chromatography", P.H. Harding, G. Panjabi, J.C. Berg, *J. Mater. Sci. Lett.*, 17(10), 1998.
- "The adhesion promotion mechanism of organofunctional silanes", P.H. Harding, J.C. Berg, *J. Appl. Polym. Sci.*, 67, 1025-1033, 1997.
- "The characterization of interfacial strength using single particle composites", P.H. Harding, J.C. Berg, *J. Adhesion Sci. Technol.*, 11(8), 1063-1076, 1997.
- "The role of adhesion in the mechanical properties of filled polymer composites", P.H. Harding, J.C. Berg, *J. Adhesion Sci. Technol.*, 11(4), 471-493, 1997.
- "Fiber surface energy effects on the mechanical properties of unidirectional fiber composites", M. Connor, P.H. Harding, J.C. Berg, J.-A. Manson, *Proc. Intl. Conf. Composite Materials*, 10th, 6, 541-548, 1995.
- "Influence of the fiber surface properties on the mechanical strength of unidirectional fiber composites", M. Connor, P.H. Harding, J.-A. Manson, J.C. Berg, *J. Adhesion Sci. Tech.*, 9(7), 983-1004, 1995.
- "Flow visualization of an air knife coating system" P.H. Harding, C.K. Aidun, *IPST Technical Paper Series Number 521*, 1994.