

# Wei-Chih Wang

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## EDUCATION

**Bachelor of Science in Electrical Engineering**, 1989  
*University of Washington, Seattle, WA.*  
**Master of Science in Engineering in Electrical Engineering**, 1992  
*University of Washington, Seattle, WA.*  
**Doctor of Philosophy in Electrical Engineering**, 1996  
*University of Washington, Seattle, WA.*

## EMPLOYMENT HISTORY

<b>Research Assistant Professor</b> <i>Department of Mechanical Engineering at University of Washington</i>	1/03 – present
<b>Lecturer</b> <i>Department of Mechanical Engineering at University of Washington</i>	3/98 – 1/03
<b>Research Associate</b> <i>Department of Mechanical Engineering at University of Washington</i>	9/97 - 3/98
<b>Post-Doctoral Fellow</b> <i>Department of Electrical Engineering, University of Hawaii at Manoa</i>	3/96 - 6/97
<b>Research Assistant and Teaching Assistant</b> <i>Department of Electrical Engineering, University of Washington</i>	3/92 – 12/94
<b>Tutor of Physics and Engineering Courses</b> <i>Instructional Center, University of Washington</i>	3/85 – 3/92

## HONORS/AWARADS

Awarded the Ford Motor Company's fellowship in 1995  
Awarded the TRW fellowship in 1994  
Runner-up for the annual best teaching assistant award of Department of Electrical Engineering, University of Washington in 1993  
Received the Teddy Miller Tutor Award, University of Washington in 1989  
Received the annual University of Washington Instructional Center Physics Tutor Award in 1988

## PUBLICATIONS

### Refereed archival journal publications

- [1] Wei-Chih Wang, M. Afromowitz, B. Hannaford, "Technique for Mechanical Measurement Using Optical Scattering from A Micro-Pipette", IEEE Trans. Biomedical Eng., March, 1994
- [2] Wei-Chih Wang, S. Yee, P. Reinhall, "Optical Viscosity Sensor Using Forward Light Scattering", Sensor & Actuator B 24-25, 1995

- [3] Wei-Chih Wang, P. Reinhall, S. Yee, "Fluid Viscosity Measurement Using Forward Light Scattering [submerged optical fibre probe]", *Measurement Science and Technology*, 10 (4), 316-22, 1999
- [4] Wei-Chih Wang, Mark Fauver, Joe N. Ho, Eric J. Seibel, Per G. Reinhall, "Micromachined Optical Waveguide Cantilever as a Resonant Optical Scanner," *SENSORS AND ACTUATORS: A.*, 102, pp.165-175, 2002.
- [5] Wei-Chih Wang, Per Reinhall, "A Novel Double-Sided Micromachining Process for Silicon Cantilever Using A Parallel Capacitively Coupled Plasma," *Journal of Microlithography, Microfabrication, and Microsystems*, accepted.
- [6] Wei-Chih Wang, Jo Nhut Ho, Jeff Wimberley, Per Reinhall, "Use of Nonlinear Vibration in Liquid Viscosity Sensing," *Journal of Sound and Vibration*, submitted
- [7] Wei-Chih Wang, Jeffrey Dee, William Ledoux, Bruce Sangeorzan, Per Reinhall, "A 3-D Force Distribution Sensor using Fiber Optic Bend Loss Sensor," *Journal of Rehabilitation Research and Development*, submitted
- [8] Wei-Chih Wang, Per Reinhall, "Reactive Ion Etching Process for Silicon Oxide and Low K Spin-On Glasses," *Journal of Electrochemical Society*, submitted
- [9] Wei-Chih Wang, Reynold Panergo, "Image acquisition using cantilever optical waveguide," *Journal of Lightwave technology*, Pending.
- [10] Wei-Chih Wang, Jeff Dee, "PDMS based distributive shear/pressure sensor," *Sensors and Actuators A*, pending.

#### **Non-journal fully refereed publications**

- [1] Wei-Chih Wang, S. Yee, P. Reinhall, "Optical Viscosity Sensor Using forward Light Scattering", *Sensor & Actuator Proc. for the Fifth Int'l Meeting on Chemical Sensors Rome, Italy 1994*
- [2] Wei-Chih Wang, P. Reinhall, S. Yee, "Fluid Viscosity and Mass Flow Measurement Using Forward light Scattering" *SPIE Proc. 2574: 146-51, 1995*
- [3] X.Zhu, E.Tran, W-C Wang, E.S.Kim, "Micromachined Acoustic-Wave Liquid Ejector", *Hilton Head Solid-State Sensor and Actuator Workshop*, 1996.
- [4] Wei-Chih Wang, Jeffrey Dee, William Ledoux, Bruce Sangeorzan, Per Reinhall, "Development of A Directional Sensitive Pressure and Shear Sensor," in *Proc. SPIE Vol. 4702*, p. 212-220, 2002
- [5] Wei-Chih Wang, Joe N. Ho, Per G. Reinhall, "Development of An Optical Waveguide Cantilever Scanner," in *Proc. SPIE 4876*, p72-83, 2002.
- [6] Wei-Chih Wang, Joe N. Ho, Per G. Reinhall, "Deep Reactive Ion Etching of Silicon Using An Aluminum Etching Mask," in *Proc. SPIE 4876*, p 633-640, 2002.
- [7] Wei-Chih Wang, Reynold Panergo, Per Reinhall, "Development of A Microfabricated Scanning Endoscope Using SU-8 Based Optical Waveguide," "2003 SPIE NDE health monitoring and Dianostics, SPIE 5047, p305-313.
- [8] Wei-Chih Wang, Reynold Panergo, Chrisopher Galvanin, William Ledoux, Bruce Sangeorzan, Per Reinhall, "A Flexible Micromachined Optical Sensor for Simultaneous Measurement of Pressure and Shear Distribution on Foot," 2003 SPIE NDE health monitoring and Dianostics, SPIE 5047, p275-285.
- [9] Wei-Chih Wang, Reynold Panergo, Kasha Toulouei, Per Reinhall, "Development of A Microfabricated Scanning Endoscope Using SU-8 Based Optical Waveguide," "2003 International Polymer fiber conference, p.98-101.
- [10] Wei-Chih Wang, Reynold Panergo, William Ledoux, Bruce Sangeorzan, Per Reinhall, "A PDMS based distributive shear/pressure sensor," 2003 International Polymer Fiber Conference, p.68-71.
- [11] Wei-Chih Wang, Reynold Panergo, "Resonant optical scanner using cantilever waveguide," *SPIE 5394*, 2004, in press.
- [12] Reynold Panergo, Wei-Chih Wang, William Ledoux, Bruce Sangeorzan, Per Reinhall, "A Flexible Micromachined Optical Sensor for Simultaneous Measurement of Pressure and Shear Force Distribution on Feet," *UW Biomechanics Symposium*, May, 2003

- [13] ChengSheng Huang, Wei-Chih Wang, "Polymer grating micro pressure sensor," 2005 SPIE NDE health monitoring and Diagnostics, accepted
- [14] Renold Panergo, Wei-Chih Wang, " Microfabricated optical scanner for image acquisition," 2005 SPIE NDE health monitoring and Diagnostics, accepted

### **Project reports**

- [1] Wei-Chih Wang, "Development of A Directionally Sensitive Pressure and Shear Sensor For Patients with Lower Limb Complications Associated with Diabetes "; submitted to RR&D Center for Excellence, VA Puget Sound Health Care System, October 2001.
- [2] Chrisopher Takahashi, Wei-Chih Wang, " Development of a wireless data acquisition system for shear sensor," submitted to RR&D Center for Excellence, VA Puget Sound Health Care System, October 2002.
- [3] Gus, Class, Wei-Chih Wang, " Development of a multichannel data acquisition system for shear sensor," submitted to RR&D Center for Excellence, VA Puget Sound Health Care System, August 2003.

### **Patents submitted and/or awarded**

- Measure fluid viscosity, mass density, and mass flow rate using forward light scattering from an optical fiber and Fiber-Optic Fabry-Perot Interferometer. (Patent Pending, Disclose to Office of Technology Transfer, Univ. of Washington, OTT ref # 05-94-78)
- Gradient or Multistep Index Microfabricated Thin Film Waveguide (Patent Pending, OTT ref # 2341-3310DL)
- Microfabricated Optical Waveguide Scanning Cantilever as a Micro-Display Device (US Patent Pending, OTT ref # 2341-3247)
- Integrated Optical Scanning Image Acquisition and Sensing Device (US Patent Pending, OTT ref # 2341-3520DL)
- A 3-D pressure distribution sensor using an integrated optical waveguide array system (US Patent Pending, IPTT Ref#2946-3802)
- A polymeric based integrated optical image acquisition and/or image display system. (Patent Pending, OTT # 2946-3917DL)
- A Novel Means of Measuring Mechanical Shear/Pressure Stress using Flexible Polymeric Sensor (Patent pending, OTL #3049-3918)
- A SU-8 based micro waveguide cantilever scanner (OTTref#3986)
- A flexible polymer based smart skin (OTT DL ref# 4005)
- Integrated Optical Scanning Image acquisition and Display (OTT ref # 2341-3986-4466PT)
- Integrated Optical Scanning Image Acquisition and Display ( US patent #10/655,482)
- Conductive polymer and its dielectric polymer actuator application ( OTT ref # 7041D )
- An ultra high resolution touch screen monitor system (OTT ref # 7042D)
- A Prosthetic Linear Incorporateing a Sensor for the Distributed Measurement of Shear and Pressure (OTT ref 7029D)
- Polymer Based Electro-Optic Scanner for Image Acquisition and Display (US Provisional patent filed)
- Polymer Based Distributive Waveguide Sensor for Pressure and Shear Measurement (US provisional patent filed)
- Flexible sensors and actuators (US patent pending)
- PENTAX Corporation finance the filing of US patent and signing optional agreement to license on Integrated optical scanning image acquisition and display system, September, 2003.
- Maskless Lithography using micro UV scanner (submitted, OTT#)
- A compact integrated electro-optic based interferometer (submitted, OTT #)

## **OTHER SCHOLARLY ACTIVITIES**

### **Invited lectures and seminars**

- Wei-Chih Wang, "Introduction to microsensors and microactuators," Department of Architecture, University of Washington, November 6, 2001
- Wei-Chih Wang, "Compact Microwave Communication systems", RF, Antennas, and Remote Sensing, University of Washington, August 5, 2002.
- Wei-Chih Wang, "Current Status and Outlook for the Micro Sensors and Actuators Development at UWME," Center for Microtechnology, March 15, 2003.
- Wei-Chih Wang, "Micro-fluidic Sensors and Actuators for Medical Applications," University of Washington Microscale Life Sciences Center, June 25, 2003.
- Wei-Chih Wang, "biomedical application using micro sensors and actuators," South Taiwan Technology University, Tainan, Taiwan, August 26, 2003.
- Wei-Chih Wang, "Development of A Microfabricated Scanning Endoscope Using SU-8 Based Optical Waveguide," 12<sup>th</sup> International Conference on Polymer Optical Fiber, Seattle, WA., September 3, 2003.
- Wei-Chih Wang, "optical waveguides, devices, applications", South Taiwan Technology University, Tainan, Taiwan, June to August 2004
- Wei-Chih Wang, " Micro Sensors and Actuators in Biomedical Applications," National ChengKung University, Tainan, Taiwan, August 6<sup>th</sup>, 2004.
- Wei-Chih Wang, " Micro Sensors and Actuators in Biomedical Applications," National Taiwan University, Taipei, Taiwan, August 15<sup>th</sup>, 2004.
- Wei-Chih Wang, " Micro Sensors and Actuators in Biomedical Applications," National Huwei University of Science and Technology, Huwei, Taiwan, August 19<sup>th</sup>, 2004.

### **Presentations given at conferences**

- [1] Wei-Chih Wang, S. Yee, P. Reinhall, "Optical Viscosity Sensor Using forward Light Scattering", Sensor & Actuator Proc. for the Fifth Int'l Meeting on Chemical Sensors Rome, Italy 1994
- [2] Wei-Chih Wang, P. Reinhall, S. Yee, "Fluid Viscosity and Mass Flow Measurement Using Forward light Scattering" SPIE Proc. 2574: 146-51, 1995
- [3] X.Zhu, E.Tran,W-C Wang, E.S.Kim,"Micromachined Acoustic-Wave Liquid Ejector", Hilton Head Solid-State Sensor and Actuator Workshop , 1996.
- [4] Wei-Chih Wang, Jeffrey Dee, William Ledoux, Bruce Sangeorzan, Per Reinhall, "Development of A Directional Sensitive Pressure and Shear Sensor," San Diego, March, 2002
- [5] Wei-Chih Wang, Joe N. Ho, Per G. Reinhall, "Development of An Optical Waveguide Cantilever Scanner," Galway, Ireland, September, 2002.
- [6] Wei-Chih Wang, Joe N. Ho, Per G. Reinhall, "Deep Reactive Ion Etching of Silicon Using An Aluminum Etching Mask," Galway, Ireland, September, 2002.
- [7] Wei-Chih Wang, Reynold Panergo, Per Reinhall, "Development of A Microfabricated Scanning Endoscope Using SU-8 Based Optical Waveguide, " 2003 SPIE NDE health monitoring and Dianostics, San Diego, March, 2003.
- [8] Wei-Chih Wang, Reynold Panergo, Christopher Galvanin, William Ledoux, Bruce Sangeorzan, Per Reinhall, "A Flexible Micromachined Optical Sensor for Simultaneous Measurement of Pressure and Shear Distribution on Foot," 2003 SPIE NDE health monitoring and Dianostics, San Diego, March 2003.
- [9] Wei-Chih Wang, Reynold Panergo, Kasha Touloei, Per Reinhall, "Development of A Microfabricated Scanning Endoscope Using SU-8 Based Optical Waveguide, " 2003 International Polymer fiber conference, Seattle, September, 2003.

[10] Wei-Chih Wang, Reynold Panergo, William Ledoux, Bruce Sangeorzan, Per Reinhall, "A PDMS based distributive shear/pressure sensor," 2003 International Polymer Fiber Conference, Seattle, September, 2003.

[11] Wei-Chih Wang, Reynold Panergo," Resonant optical scanner using cantilever waveguide," San Diego, March, 2004.

### **Professional society memberships**

IEEE (1986-1996)  
Eta Kappa Nu (1996- present)  
OSA(1992-1998)  
SPIE( 2004 -present)

### **GRADUATE STUDENTS**

#### **Chaired doctoral degrees**

- Joe Ho, Mechanical Engineering (expected year of completion: June 2006)
- Chen-Shen Huang, Mechanical Engineering (expected year of completion: June 2007)
- Chu-Yu Huang, Mechanical Engineering (expected year of completion: June 2008)

#### **Chaired masters degrees**

- Reynold Panergo , Mechanical Engineering (expected year of completion: June 2005)
- Jiang Shiao, Mechanical Engineering (expected year of completion: June 2006)

#### **Other significant student supervision**

- Michael Philetus Weller, architecture master thesis, "self-assembling building blocks", June, 2003
- Michael Philetus Weller, architecture Ph.D. (expected year of completion: 2007)
- Chia-Hsien Hsu . Mechanical Engineering (expected year of completion: June 2006)
- Joe Ho, Mechanical Engineering, "Numerical Investigation for Nonlinear Behavior of a fiberoptic viscometer," Mechanical Engineering master thesis, Decemeber, 2002

### **RESEARCH ACTIVITES**

#### **Sponsored Research**

Grant number # 119024 Eric J. Seibel (PI) \$40,000 7/1/99-6/30/01 (Completed)  
Washington Technology Center MEMS Research Fund  
"Resonant Waveguide Cantilever Designed as MEMS Optical Scanner"  
Role: Research Scientist

Grant number A2661C Bruce J. Sangeorzan (PI) \$62,000 9/02/99-6/31/04  
Department of Veterans Affairs  
"Center for Excellence in Limb Loss Prevention and Prosthetic Engineering "  
Role: Research Scientist

Grant number 1 R21 EB003406-01 Wei-Chih Wang (PI) \$399,462 4/01/04/-3/30/06  
National Institutes of Health  
In-Shoe Shear Stress Sensor For Diabetic Patient  
Role: PI

Grant number 6340722 Wei-Chih Wang(PI) \$853,004 10/01/04 – 9/30/07 (Pending)

National Science Foundation  
“Development of A Novel Electro-Optic Scanning Image Acquisition System for Minimum Invasive,  
High Resolution/ High-Field –of-View Endoscopic Imaging Applications”  
Role: PI

Grant number na Wei-Chih Wang (PI) \$401,659 1/01/05/-12/31/06 (Pending)  
NIH/NIBIB  
“Development of An Ultrahigh Resolution, Variable Field Of View Endoscope Using A Novel Electro-  
Optic Scanner”  
Role: PI

Grant number 6276733 Reinhall(PI) \$353,517 6/16/04-6/15/07 (Pending)  
National Science Foundation  
“A flexible distributive waveguide sensor for quantifying plantar pressure and shear stress during gait”  
Role: Co-PI

Grant number Ledoux (PI) \$750,000 7/1/04-6/30/07 (Pending)  
Department of Veterans Affairs  
“shear stress in transtibial prosthetic sockets”  
Role: Co-Investigator

Grant number Bruce J. Sangeorzan (PI) \$50000 9/30/04  
Department of Veterans Affairs  
“Center for Excellence in Limb Loss Prevention and Prosthetic Engineering “  
Equipment fund  
Role: subcontract

## Un-sponsored Research

***Integrated optical scanning image acquisition and sensing device***  
(09/99-present)  
Future possible funding from PENTAX (PENTAX has signed the optional agreement to license)

***Ultra high speed (100Ghz) polymer based optical scanning endoscope***  
(06/01- present)  
Future funding

***Novel composite polymer sensors and actuators***  
(03/01-present)  
Future funding

***Directional microphone using micro fabricated hot wire sensor***  
(06/06- present)  
Publication

***Fiberoptic based fluid viscosity and flow sensor***  
(06/89-present)  
Publications and Future funding

***Polymer based multi-parameter sensor system (smart skin)***  
(03/01-present)  
Future funding

***Plasma etching process on low k dielectric materials***

*(01/01- present)*

*Publications*

***3-D microfabrication technique for high frequency devices***

*(06/96- present)*

*Publications and Future funding*

***Fiber optic based distributive fault line detection system***

*(09/99 to present)*

*Publications and Future funding*

***Fiber optic based IR spectrometer for health monitoring***

*(03/02 to present)*

*Future funding*

***Micro actuator for steering scanning endoscope***

*(01/02 to present)*

*Future funding*

***Anonymous robotic mapping unit***

*(12/01 to present)*

*Publications*

***Self Assembly modular robot***

*(03/03 to present)*

*Publications and Future finding*

***Micro-Machined Acoustic Wave Liquid Ejector***

*(02/96 to present)*

*Publications*

***Dome-shaped diaphragm micro-transducers***

*(02/96 to present)*

*Publications*

***FEM modeling of composite structure for ZnO based flat diaphragm transducer***

*(12/96 to present)*

*Publications*

***Fluid viscosity measurement using fiber-optic Fabry-Perot interferometer***

*(12/91 to present)*

*Future funding*

***Directional strain measurement using fiber-optic polarimetric sensor***

*(12/94 to present)*

*Publications and Future funding*

***Strain and viscosity measurement using elliptical core two mode fiber-optic sensor***

*(6/93 to present)*

*Publications and Future funding*

***Use of Nonlinear Vibration in Liquid Viscosity Sensing***

*(12/95 to present)*

*Publications*

## **SUPERVISION OF UNDERGRADUATE INDEPENDENT STUDY**

- Christopher Takahashi, Jeff Dee, Joshua Weinstein and Samuel Radochonski are recipients of Mary Gates Undergraduate Research Fellowships (2002-2004)
- Advised more than 50 undergraduate students in the undergraduate Student Research Program, 1998 to present, some of them are listed:  
Jeff Dee, Joshua Weinstein and Christopher Takahashi, Billy Chow, Tuan Le, Gus Class, Samuel Radochonski, Mike Wong, Michelle Bler, Khsha Toulouei, Michael Pheletus, Joe Ho, James Etcorn, Coji Kuwahara, Jo Ho, Colin Liles, Christopher Galvanin, Michelle Gamble, Daniel Ortiz, Daniel Chang, Daniel Chen, Loren Wallace, Taguchi Blayne H P ,Reynold Panergo, Cheng-Sheng Huang, Ting Wang, Neing Wang, Al Toweilly, Mathew Hummer, Nigel Steer, Krittramom Tejavimbhya, Jake Hitero, Geoffery Greenleaf, Josh Weltman, Christopher Brown, Ann Ng, David Lanning, mechelle maureene ,Zac Hendrickson, Cheng Kim, Kevin Leong, Kevin Wang, Chanadejh Sachalathorn, Steve Evans, Mike Hansen, Betty Wang, Jeffery Wimbeery, Betty Wang, Maggie Wang, Mark Pacpaco, Melissa Wang, Huyen Nguyen, Tien Ngyuen, George Stults, Huam Pham, Tim Cass, Dung Nguyen, Hamed Khoojinian, Inwoo kim, Rick Yin, Daniel Kim, Daniel Chang, Amber , nicolas noel stephensen., Billy Chow, Ignacio Shin, Christopher K Willey, Zac Hendrickson, jae hyun kim, David Wu, Kevin Leung, Thurston, Ryan, mechelle maureene, Benjamin Burt Estroff, gurmeet singh ghumman, Brian Porter, Keegan Wincewicz, Yohan K. Han, Chong S. Kim, Raymond Chung, Josie Imlay, Zia Quadir, Abram Clark, Inwoo Kim, Lee, Jane Jun, Moseid, Benjamin Lawrence, Josie Imlay, Tri Pham, Christopher lee, Cameron lee, Billy Tuang

## **SERVICE**

### **College Service**

- Faculty mentor for IWT Virtual Development Center, University of Washington, 2001-2002
- Engineering Openhouse exhibit for engr100 and ME undergraduate research (1999-present)
- Integrating biological diversity into the mechanical engineering curriculum planning committee (2004 - present)

### **University service**

- Started an international exchange program with Electrical Engineering Department, South Taiwan Technology University, Tainan, Taiwan, 2003 to present.
- Serve in the Review committees for Mary Gates Endowment for Students Research Training Grants, 2003 to present.
- Serve in the Qualify Exam committees in Department of Mechanical Engineering, University of Washington, 2004.
- Serve in the Biomechanics planning committees for Department of Mechanical Engineering, University of Washington, 2003 to present.
- Faculty mentor for Design Machine Group, Architecture Department, University of Washington, 2000-present
- Faculty mentor for UW outreach program, June 2000.

### **Professional society and other service**

- Invited Chair for Biomechanics session in Smart Structure and Materials and Nondestructive Evaluation for Health Monitoring and Diagnostics Conference, San Diego, CA., 2003, 2004 and 2005.



**Community service**

- Faculty Mentor for Seattle YMCA outreach program, April 2001.

**All other service**

- Japanese Baptist Church Choir director (2001- present)
- Japanese Baptist Church Worship Committee (2000-2003)
- Chinese Gospel Chorale (1998 to present)
- The Seattle Tudor Choir (1993 to present)
- Provide Music for Monthly Sunday service at Nikei Menor, Seattle (1998- present)