

## Yen-Lin Han

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### EDUCATION:

- 08/01-05/06      **University of Southern California**      Los Angeles, CA  
Ph.D., Mechanical Engineering, GPA 3.83  
Dissertation: "Investigations of Micro/Meso-Scale Knudsen Compressors at Low Pressures"  
Advisor: Dr. E. P. Muntz
- 01/07-08/08      **University of Southern California**      Los Angeles, CA  
Master of Science, Electrical Engineering, GPA 3.74  
Major Field: Optics, Photonics
- 08/99-05/01      **California State University Northridge**      Northridge, CA  
Master of Science Program, Mechanical Engineering, GPA 3.98  
Major Field: Heat Transfer, Thermal-Fluids  
Advisors: Dr. S. Schwartz
- 08/98-08/99      **California State University Dominguez Hills**      Carson, CA  
Master of Business Administration, General Management, GPA 3.93
- 10/89-05/93      **National Tsing-Hua University**      Hsin-Chu, Taiwan  
Bachelor of Science, Material Science and Engineering  
Minor, Economics

### WORK EXPERIENCE:

- 09/15-Present      **Seattle University**      Seattle, WA  
*Assistant Professor, Department of Mechanical Engineering*  
09/12-08/15      *Lecturer/Instructor, Department of Mechanical Engineering*

#### ***Courses Taught:***

**Senior Design Projects-** Coordinate Capstone Senior Design Projects (6 projects in 2012-2013, 10 projects in 2013-2014 and 7 projects in 2014-2015). Advise teams of students completing engineering tasks provided by industrial sponsors. Prepare students with profession presentation and writing skills. Lecture on project management, and teamwork. Apply fundamental engineering theories including thermal fluids, dynamics, control, and materials. Complete each project with prototyping, testing, professional presentations, and technical reports to sponsors.

**Kenworth project advised in 2015-16 is currently being evaluated by PACCAR for patent application.**

**Heat Transfer-** Topics include general principles underlying heat transfer by conduction, convection, and radiation for applying steady flow and transient flow. Conduct experiments to demonstrate selected heat transfer phenomena. Research supported by NSF DUE-TUE on utilizing inverse classroom (IC) to facilitate authentic engineering problem centered learning (AEPCL) in Heat Transfer class was conducted for 2014 & 2015.

**Dynamic Systems-** Topics include modeling of mechanical, thermal, hydraulic, pneumatic, and electrical linear and non-linear systems, Laplace transforms, stability criteria, and frequency response. Emphasize on computer simulation using existing

symbolic computer programs such as MATLAB Simulink. Re-designing laboratory experiments utilizing LabView/NI DAQ to observe time responses of selected mechanical, hydraulic and electromechanical systems is in progress.

**Fluid Mechanics-** Topics include laws of conservation of mass, momentum, and energy in fluid systems, fluid statics, dimensional analysis, incompressible, inviscid and viscous flows, steady and unsteady flows, internal and external flows.

**Introduction to MEMS (Microelectromechanical Systems)-** Topics include design, scaling, fundamental fabrication techniques, material selection, and actuation of microelectromechanical systems. Emphasize on state-of-the-art MEMS sensing technology to enhance understanding of contemporary issues and global awareness.

**Research Interests:** Utilizing simulation techniques to design heat transfer, microfluidics, nanofluidics and Microelectromechanical Systems (MEMS) including micropumps, microvalves, microthrusters, and micro heat sinks. Proficient at packaging software such as COMSOL, ANSYS Fluent, SolidWorks, etc. Applications of advanced materials including Aerogel and Carbon Nanotubes in innovated devices such as Single Chamber Solid Oxide Fuel Cells, self-driven micro combustor, and Trace Gas Preconcentrators. Design of biomedical devices such as tumor thermal ablation probes.

**Professional Service:** Session Organizer- ASME IMECE Conference, 2014. Panelist – NSF IUSE & NDSEG- 2016

01/10-08/12

**University of Connecticut**

Storrs, CT

*Assistant Professor-in-Residence, Department of Mechanical Engineering*

**Courses Taught:**

**Senior Design Projects-** Coordinated Capstone Senior Design Projects (41 projects in 2010-2011, and 51 projects in 2011-2012). Advised teams of students completing engineering tasks provided by industrial sponsors. Successfully advised design projects include Robotic Silicon Wafer Grippers, Green Renewable Energy Sources Optimization, Restoration of Museum of Connecticut Glass, Voltage Regulators for Farmers in Developing Countries, An Innovative Cooling Device for Firefighters, Re-design the Combustor of an Air-Steam Hybrid Engine, Tire Cage Failure Analysis, Design and Manufacturing of an Interface for the Laser Bake Stand, etc.

**Thermodynamics Principles-** Topics included determining the properties of pure substances using the thermodynamic tables, ideal gas approximation and other equations of state and the applications of the conservation of energy to steady and unsteady flows, and applying the second law of thermodynamics to steady and unsteady flows. *Taught on-line course in Summer 2012.*

**Applied Thermodynamics-** Focused on the applications of thermodynamic principles to the design and optimization of engineering systems including the vapor power and refrigeration systems, gas power systems, applications concerning humidification, dehumidification, evaporative cooling, and thermodynamics of combustion systems such as furnaces, flow reactors etc. Characterized Turbosteamer hybrid engines in design projects.

**Fluid Dynamics-** Lectured on fundamental fluid dynamics theories including applications of the Navier-Stokes equations and computational fluid dynamics (CFD) projects using ANSYS FLUENT.

**Heat Transfer-** Lectured on general principles of heat transfer including conduction, convection, and radiation. Analyzed the design of heat sinks for computer CPU in design projects.

**Service:**

Seminar organizer- Coordinated Mechanical Engineering Seminar Series and Distinguished Lectures. Invite twelve renowned seminar speakers in 2011-2012.

06/02-12/09

**University of Southern California**

Los Angeles, CA

*Lecturer, Department of Aerospace and Mechanical Engineering*

**Courses Taught:**

**Senior Projects Laboratory-** Mentored individual engineering research projects designed and constructed to model and test physical principles or systems. Lectured on fundamental Mechatronics including computer-aided design (CAD) package software (SolidWorks, Solid Edge), data acquisition (LabView), and basic machining processes (conventional machining, CNC machining, and 3-D printing).

**Introduction to MEMS (Microelectromechanical Systems)-** Introduced principles of MEMS design, fabrications, and testing.

**Thermal System Designs-** Topics included optimization techniques, engineering design, engineering economics, Lagrange multipliers, linear programming, finite element method (FEM) etc.

**Strength of Materials-** Topics included stress and strain, torsion, pure bending, analysis and design of beams for bending, deflection of beams.

**The Kinetic Theory of Gas Flows in Nano/Micro-Scale Environments (graduate level)-** Topics included Gas Kinetic Theory, gas surface interaction, Direct Simulation Monte Carlo (DSMC), Molecular Dynamics (MD) simulations.

**Heat Transfer-** Lectured on general principles of heat transfer including conduction, convection, and radiation.

**Thermodynamics-** Lectured on fundamental laws of thermodynamics.

*Postdoctoral Research Associate, Department of Aerospace and Mechanical Engineering*

Research topics: Experimental and computational investigation on molecular transport phenomena in micro/nano-scale channels including single-walled and multi-walled carbon nanotube membranes. Fabrication of multi-walled carbon nanotube membranes. Researching micro/nano-scale transport phenomena with an emphasis on the design and testing of the **patented Continuous Trace Gas Preconcentrator** for gas sensing technology. MEMS fabrication procedures for Knudsen Compressors, a micro-scale thermally driven gas pump. Investigating temperature driven flows by various wall temperature profiles in micro channels using Direct Simulation Monte Carlo technique. Applications of radiometric forces on micro thrusters. Published results in highly respected peer reviewed journals. Submitted proposals to NASA, NSF and several private sectors.

*Teaching Assistant, Department of Electrical Engineering*

**Solid State Processing-** Independently led students in the integrated circuit fabrication laboratory with basic micro-machining processes. Designed laboratory projects for Microelectromechanical System Laboratory class. Cleanroom certified.

*Teaching Assistant, Department of Aerospace and Mechanical Engineering*

**Senior Projects Laboratory-** Supervised and guided students on fundamental design and manufacturing processes as well as characterization procedures for various mechanical engineering systems.

**Compressible Gas Dynamics-** Assisted students with their questions on fundamental compressible gas dynamics problems such as subsonic and supersonic flows, shock waves, and computational fluid dynamics (CFD).

Research Assistant, Department of Aerospace and Mechanical Engineering

Developed micro/meso-scale low pressure Knudsen Compressor, adopting the rarefied gas dynamic theory of thermal transpiration (creep). Worked on many facets of the Knudsen Compressor; including design, experimental investigations, and DSMC Simulations. Investigated gas flow and thermal properties of nanoporous materials such as Aerogel, beds of glass microspheres, and porous glass. Manufactured Xerogel sample. Invented a **Continuous Trace Gas Preconcentrator** for advanced trace gas sensing technology.

10/96-06/98

**ATT Group**

Taipei, Taiwan

Brand Supervisor

Managed famed European fashion brand **Mango** in Taiwan. Trained hundreds of sales representatives. Developed marketing strategy to generate sales from half a million dollars to more than two million dollars per year within two years. Researched fashion trends in major European cities. Planned and executed numerous fashion shows.

12/93-11/95

**Giordano, East Jean Co. Ltd.**

Taipei, Taiwan

Manager Trainee, Independent Store Manager, Human Resource Trainer

Managed an individual retail store. Developed training courses. Trained and managed sales representatives.

**PATENTS:**

**Provisional patent:** Ablation Heating Probe with Expandable Electrodes, filed on 04/07/2016, Yen-Lin Han.

**Patent:** Pre-Concentrator for Trace Gas Analysis, Pub. No: US2008/0178658 A1, Pub. Date: Jul. 31, 2008, E. P. Muntz, Y.-L. Han, M. Young.

Provisional patent: A thermally driven micropump with a built-in microvalve, 09/09, Yen-Lin Han.

Provisional patent: Quantum Separator – Continuous Micro and Meso Scale Pre-Concentration of Trace Molecules in Gases, 60/729,679, 2005, E. P. Muntz, Y.-L. Han, M. Young.

Provisional patent: Radiantly Driven Knudsen Compressor, 60/613,366, 2004, M. Young, Y.-L. Han, E. P. Muntz.

**REFEREED JOURNAL PUBLICATIONS (with undergraduate student's name underlined):**

Lau, Lawrence, Han, Y.-L., “Exploring a Novel Heating Probe Design for Tumor Ablation”, ASME Journal of Medical Device, To Be Published.

Zhao, S., Jiang, B., Maeder, T., Mural, P., Kim, N., Matam, S. K., Jeong, E., Han, Y.-L., and Koebel, M. M., “Dimensional and Structural Control of Silica Aerogel Membranes for Miniaturized Motionless Gas Pumps”, Applied Materials and Interfaces, Volume 7, No. 33, pp 18803–18814, Aug. 2015.

Muntz, E.P., Han, Y.-L., “Performance Analysis of the Continuous Trace Gas Preconcentrator”, Physics of Fluids, Volume 23, 030605, 2011.

Han, Y.-L., “Working Gas Temperature and Pressure Changes for Microscale Thermal Creep Driven Flow Caused by Discontinuous Wall Temperatures”, Fluid Dynamics Research, Volume 42, 045505, 2010.

Han, Y.-L., Young, M., “Continuous Preconcentrator for Trace-Gas Analysis”, Recent Patents on Mechanical Engineering, Volume 2, No. 3, pp. 214-227, November 2009.

Han, Y.-L., “Thermal-Creep-Driven Flows in Knudsen Compressors and Related Nano/Microscale Gas Transport

Channels”, Journal of Microelectromechanical Systems, Volume 13, Issue 4, pp. 984-997, August 2008.

*Han, Y.-L.*, Muntz, E.P., “An Experimental Investigation Micro/Meso-Scale Knudsen Compressors at Low Pressures”, Journal of Vacuum Science & Technology B: Microelectronics and Nanometer Structures, Volume 25, Issue 3, pp. 703-714, May 2007.

*Han, Y.-L.*, Alexeenko, A. A., Young, M., Muntz, E. P., ”Experimental and Computational Studies of Temperature Gradient Driven Molecular Transport in Gas Flows Through Nano/Micro-Scale Channels”, Nanoscale and Microscale Thermophysical Engineering, Volume 11, Issue 1 & 2, pp. 151-175, January 2007.

**REFEREED CONFERENCE PROCEEDINGS (with undergraduate students names underlined):**

*Han, Y.-L.*, ”Computational Studies on the Effects of Non-linear Temperature Functions in Thermal Creep Membranes of Radiantly Driven Knudsen Compressors”, Proceeding of IMECE2015-51813, ASME International Mechanical Engineering Congress and Exposition, Houston, Texas, 2015.

Bever, A. M., Brown, P. J., Lane, K. V., Levy-Wendt, B. L., Yasuda, N., Han, Y.-L., and Shih, F. J., “Characterization of a Fast Responding Composite Thermal Bimorph Actuator Based on Carbon Nanotube Sheets”, Proceeding of IMECE2015-52576, ASME International Mechanical Engineering Congress and Exposition, Houston, Texas, 2015.

Shuman, T.R., Mason, G., Han, Y.L., and Cook, K., “Facilitating Problem-Based Learning with an Inverted Classroom” Proceedings of the 6th International Symposium on Industrial Engineering – SIE 2015, Plenary Session, Belgrade, Serbia, September 24-25, 2015

Mason, G. S., Shuman, T. R., Han, Y. L., and Cook, K. E., “Facilitating Problem-Based Learning with an Inverted Classroom” Proceeding of 2015 ASEE Annual Conference and Exposition, Seattle, Washington. 10.18260/p.24089, June, 2015

*Han, Y.-L.*, ”Computational Study on a Novel Micropump Driven by a Built-In Thermal Bimorph Microvalve”, Proceeding of IMECE2014-38708, ASME International Mechanical Engineering Congress and Exposition, Montreal, Canada, 2014.

Bever, A. M., Levy-Wendt, B. L., del Rosario, V., Pentz, J. A., Han, Y.-L. and Shih, F. J., “In-Plane Thermal Conductivities of CFRP Composites Interleaved with Dissimilar Conductive Media”, Proceeding of IMECE2014-38923, ASME International Mechanical Engineering Congress and Exposition, Montreal, Canada, 2014.

*Han, Y.-L.*, ”Performance Model for Optically Driven Micropumps with Carbon Opacified Aerogel Membranes”, Proceedings of IMECE2013-62197, ASME International Mechanical Engineering Congress and Exposition, San Diego, CA, 2013.

*Han, Y.-L.*, ”Simulation Studies of Micro-Scale Gas Pumps Driven By Isolated Heating Elements Induced Thermal Creep Flows”, Proceedings of IMECE 2009-10856, ASME International Mechanical Engineering Congress and Exposition, Lake Buena Vista, Florida, 2009.

*Han, Y.-L.*, “Investigation of Temperature Driven Gas Flows In 4 nm Channels for Applications Of Micro-Scale Compressors at above Atmospheric Pressure”, Proceedings of IMECE 2008-68170, ASME International Mechanical Engineering Congress and Exposition, Boston, 2008.

*Han, Y.-L.*, Young, M., Muntz, E.P., “Performance of Micro/Meso-Scale Thermal Transpiration Pumps at Low Pressures”, Proceedings of IMECE 2004-61807, ASME International Mechanical Engineering Congress and Exposition, Anaheim, CA, 2004.

Muntz, E.P., Young, M., *Han, Y.-L.*, “Continuous Low Power Pre-Concentrations for Distributed Microscale Trace Gas Analysis”, Proceedings of IMECE 2004-60874, ASME International Mechanical Engineering Congress and Exposition, Anaheim, CA, 2004.

Young, M., Han, Y.-L., Muntz, E.P., Shiflett, G., "Characterization of a Radiantly Driven Multistage Knudsen Compressor", Proceedings of IMECE 2003-41486, ASME International Mechanical Engineering Congress and Exposition, Washington D.C., 2003.

#### **INVITED BOOK CHAPTER:**

Han, Y.-L., Aerogel Materials for Aerospace, in S. Zhang & D. Zhao (Eds.), *Aerospace Materials Handbook (Advances in Materials Science and Engineering)*, CRC-Press, Boca Raton, FL, pp. 699-743, 2012.

#### **CONFERENCE PROCEEDINGS:**

Han, Y.-L., "Implications of Imposing Working Gas Temperature Change Limits on Thermal Creep Driven Flows", 26<sup>th</sup> International Symposium on Rarefied Gas Dynamics, Kyoto, Japan, July 21 - 25, 2008.

Muntz, E.P., Alexeenko, A.A. Gimelshein, S.F., Ketsdever, A.D., Han, Y.-L., Young, M.P., Park, J.H., Ngalande, C., Selden, N.P, Lee, R.H., "Low Speed Nano/Micro/Meso-Scale Rarefied Flows Driven by Temperature and Pressure Gradients", Rarefied Gas Dynamics, Ed. M. S. Ivanov, A.K. Rebrov, pp. 1085-1092, Novodibirsk Publishing House of the Siberian Branch of the Russian Academy of Sciences, Russia, 2007.

Han, Y.-L. Alexeenko, A. A., Young, M., Muntz, E. P., "Experimental and Computational Studies of Temperature Gradient Driven Molecular Transport in Gas Flows Through Nano/Micro-Scale Channels", Proceedings of the 2<sup>nd</sup> International Conference on Transport Phenomena in Micro and Nanodevices, 2006.

Han, Y.-L., "Investigation of Knudsen Compressors at Low Pressures" Ph.D. Thesis, University of Southern California, Los Angeles, CA, May 2006.

Han, Y.-L., Young, M., Muntz, E.P., Shiflett, S., "Knudsen Compressor Performance at Low Pressures", 24<sup>th</sup> International Symposium on Rarefied Gas Dynamics, AIP Conference Proceedings 762, Ed. M. Capitelli, pp. 162-167, Melville, New York, 2005.

Young, M., Han, Y.-L., Muntz, E.P., Shiflett, S., "Characterization and Optimization of a Radiantly Driven Multi-Stage Knudsen Compressor", 24<sup>th</sup> International Symposium on Rarefied Gas Dynamics, AIP Conference Proceedings 762, Ed. M. Capitelli, pp. 174-179, Melville, New York, 2005.

Young, M., Han, Y.-L., Muntz, E.P., Shiflett, S., Ketsdever, A, Green, A., "Thermal Transpiration in Microsphere Membranes", 23<sup>rd</sup> International Symposium on Rarefied Gas Dynamics, AIP Conference Proceedings 663, Eds. A. D. Ketsdever and E. P. Muntz, pp. 743-751, Melville, New York, 2003.

#### **PRESENTATIONS:**

Han, Y.-L., "Single-chamber solid-oxide fuel cells driven by thermal transpiration Knudsen Compressors", The Energy & Materials Research Conference (EMR2012), Torremolinos-Malaga, Spain, June 20-22, 2012.

#### **INVITED TALKS:**

Han, Y.-L., "Applications of Molecular Gas Dynamics to MEMS Devices", Invited Talk for Mechanical and Aerospace Engineering Seminar, Syracuse University, Syracuse, NY, Oct. 28, 2011.

Han, Y.-L., "Applications of Molecular Gas Dynamics to MEMS Devices", Invited Talk for Aerospace and Mechanical Engineering Seminar, University of Southern California, Los Angeles, CA, Sep. 21, 2011.

Han, Y.-L., "Gas Transport Phenomena in Micro/Nano-Scale Channels Applied in Knudsen Compressors and Continuous Trace Gas Preconcentrators", Invited Talk for Mechanical Engineering Seminar, Santa Clara University, Santa Clara, CA, Apr. 13, 2009.

Han, Y.-L., “Investigation of Transport Phenomena in Micro/Nano/Subnano-Scale Channels Applied in Knudsen Compressors and Continuous Trace Gas Preconcentrators”, Invited Talk for Mechanical Engineering Seminar, Vanderbilt University, Nashville, TN, Oct. 31, 2006.

Han, Y.-L., “Investigation of Transport Phenomena in Micro/Nano/Subnano-Scale Channels Applied in Knudsen Compressors and Continuous Trace Gas Preconcentrators”, Invited Talk for Mechanical Engineering Seminar, Virginia Commonwealth University, Richmond, VA, Sep. 18, 2006.

Han, Y.-L., “Low Pressure Performance of Micro/Meso-Scale Knudsen Compressors”, Aerospace and Mechanical Engineering Seminar, University of Southern California, Los Angeles, CA, Apr. 12, 2006.

### **RESEARCH GRANTS:**

11/15 NSF- *Vertically Aligned Carbon Nanotube Membranes Applied to Continuous Trace Gas Separation* (PI)- \$292,906  
11/14 NSF- *Continuous Trace Gas Separator with Vertically Aligned Carbon Nanotube Separation Membranes* (PI)- \$293,505  
10/13 NSF- *Facilitating Problem-Based Learning with an Inverted Classroom* (Co-PI): **Awarded-** \$171,306  
10/13 NSF- *Collaborative Research: Self-Sustaining Thermochemical Pumping and Power Generation At Mesoscales* (Co-PI): Rated as “Highly Recommended”- \$171,140  
01/13 NSF- *Collaborative Research: Novel Miniature Self-Sustaining Thermochemical Pumping and Power Generation* (Co-PI): Rated as “Highly Recommended”- \$169,901  
01/11 Pratt and Whitney- *The Second Law Optimization Analysis for GTE Applications* (PI): **Awarded-** \$60,000  
08/10 Pratt and Whitney- *The Availability Analysis Methodology For Competitive Assessments of GTE Applications* (PI): **Awarded-** \$35,171  
04/09 XEROX Academic Research Foundation- *MEMS Fabricated Mirror To Replace High Performance Polygon Motor* (Co-PI): **Awarded-**\$40,000  
10/08 DARPA-BAA-08-75- *Two-Stage Chip-Scale Micro Pump* (Co-PI): Rated as “Selectable”  
08/08 NASA 08-PIDD08-0057- *Solid state gas pumps and compressors for planetary science instrumentation* (Key Personal): Rated as “Selectable”  
08/07 NASA 07-MIDP07-0007- *Application and optimization of low-power scalable gas pumps and compressors for the exploration of Mars* (Key Personal): Recommended  
01/07 NSF- *Chemical Reaction Driven Thermal Transpiration Pumping in Nanostructured Materials* (Post-Doc): Recommended

### **AWARDS:**

2013-2015 NSF DUE: “Facilitating Problem-Based Learning with an Inverted Classroom”  
2010-2011 Pratt and Whitney & UConn Center of Excellence Research Grants  
2009-2011 Xerox Academic Research Grant  
2008 University of Southern California, Viterbi School of Engineering New Initiatives  
2008 Travel Award, 26<sup>th</sup> International Symposium on Rarefied Gas Dynamics  
2006 Travel Subsidy, Second International Conference on Transport Phenomena in Micro and Nanodevices from National Science Foundation  
2006 Academic Achievement Award, University of Southern California  
2004-2006 WiSE (Women in Science and Engineering) Grant, University of Southern California  
2004 Student Travel Award, 24<sup>th</sup> International Symposium on Rarefied Gas Dynamics

### **MEMBERSHIPS:**

Member of ASME  
Member of ASEE

Member of Phi Kappa Phi Honor Society

**REFEREED PAPERS:**

ASME Design of Medical Devices (DMD) Conference Proceedings: (Dec 15)  
Journal of Vacuum Science B: (Dec 15)  
ASME Journal of Fluids Engineering: FE-14-1477 (Sep. 14)  
Journal of Mechanical Science and Technology: MEST-D-13-00393 (Jun. 13)  
Continuum Mechanics and Thermodynamics: CMAT-D-12-00048 (Oct. 12)  
Energy Conversion and Management: ECM-D-12-00928 (Oct. 12)  
Microfluidics and Nanofluidics: MNF02012 (Feb. 12)  
Microfluidics and Nanofluidics: MNF3611 (Mar. 11)  
Microfluidics and Nanofluidics: MNF78210 (Feb.10)  
Sensors & Actuators: A. Physical: SNA-D-09-00788 (Jan. 11)  
Sensors & Actuators: A. Physical: SNA-D-10-00426 (Oct. 10)  
Sensors & Actuators: A. Physical: SNA-D-10-00670 (Aug. 10)  
Nanoscience and Nanotechnology Letters: 4303 (Aug 10)  
Microfluidics and Nanofluidics: MNF69709  
Microfluidics and Nanofluidics: MNF66609  
Microfluidics and Nanofluidics: MNF59309  
Physical Review E: EC10594  
Microfluidics and Nanofluidics: MNF54809  
Microfluidics and Nanofluidics: MNF39108  
Physics of Fluid: "Frequency-Dependent Free-Molecular Heat Transfer of Vibrating Cantilever and Bridges"