

Peter Jacquemin - PhD

Dual U.S. and Canadian citizenship

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Expertise: Applied physics in optics and holography, photonics, optical instrumentation, adaptive optics, mechanisms design, feedback control system design, analog circuit electronics design, and image processing.

Please visit my website www.pbjacquemin.com to view my optical-mechanical designs and lab research.

Open tab "Projects and Research" and select "Optical Target Tracking" to view a precision optical target tracking and laser pointing device in a high vibration moving body environment. Click on "Scanning Mechanisms" to view vibration isolation and optical jitter suppression mechanisms. Select "Scanning using Coherent Beam Interference" to see a luggage scanning device for homeland security. Open tab "Professional Development" to view recent academic research in holography, tomography, and microscopy.

Education

Ph.D. Mechanical Engineering, University of Victoria, BC, May 2010

M.Sc. Mechanical Engineering, San Jose State University, CA, May 1980

B.Sc. Mechanical Engineering, San Jose State University, CA, Dec 1978

Education Program, University of Victoria, BC, Sep 2001 to May 2003

AutoCAD R14 Level I & II and Introduction to C Programming, Camosun College, Victoria, BC 1998

Academic PhD Research: Developed a CSLH (Confocal Scanning Laser Holography) Microscope

- Designed, built, and evaluated a proof-of-concept microscope that reconstructs the 3D temperature distribution of a fluid from scanned holograms and provides phase imaging within the transparent regions of the specimen.
- Derived a unique limited viewing angle 3D tomographic reconstruction algorithm from measured holograms.
- Derived medical image processing algorithms that use high resolution digital signal filtering methods.
- Wrote all experiment control, data analysis, and image processing software and reported in a 425 page thesis.
- Applications include minute fluid motion studies in microgravity, phase imaging microscopy, and refractometry.
- Developed image processing algorithms for Optical Coherence Tomography retinal scan imaging systems.

Analytical and Laboratory Support to Develop an ACHM (Acoustic Confocal Holography Microscope)

- Developed an ultra-sound holographic scanning device to detect cancer cells using a spatially coherent beam interference method to measure acoustic impedance and wave propagation velocity instead of temporal methods.
- Derived a narrow viewing angle 3D tomographic reconstruction algorithm for diagnostic measurements.

Adaptive Optics

- Space Based Laser program wavefront correction that maximizes energy deposition on a moving target.
- Real-time atmospheric turbulence correction and optical aberration correction for off-axis scanning systems.
- Collaborated with the University of Victoria and Herzberg Institute of Astrophysics adaptive optics groups.
- Presentations to adaptive optics groups on various topics including:
 - 1) "Telescope Optics Design using Zemax Lens Design Software"
 - 2) "A Digital Crossover Design for a MEMS Woofer-Tweeter Deformable Mirror"
 - 3) "High-Order Digital Lead-Lag Compensator Design for Extended Bandwidth AO Feedback Control"
 - 4) "Tip-Tilt Stages for Deformable Mirrors while Maintaining a Stationary Pupil on the Wavefront Sensor"
 - 5) "A Study of the z-Transform Bilinear Transform Error with Respect to Sparsely Sampled Data Waveforms"
 - 6) "A Tomographic Reconstruction Algorithm to Determine Altitude Specific Atmospheric Turbulence"

Contracting Experience - Apr 1998 to Jun 2001

- Designed, built, and field tested a handheld acoustical listening device to detect faint distress calls for Coast Guard Search and Rescue. Designed and tested signal processing electronics to reduce background noise.
- Designed and built a wide frequency band vibration isolation mechanism and digital audio processors.

Aerospace Experience - May 1978 to Aug 1993

Coleman Research Corporation, Huntsville, AL	Sensor Engineer	Jun 1991 to Aug 1993
Summa Technology, Huntsville, AL	Sensor Engineer	Mar 1991 to Jun 1991
Teledyne Brown Engineering, Huntsville, AL	Laser Tracking	May 1986 to Mar 1991
Lockheed Corporation, Sunnyvale, CA	Research Engineer	May 1978 to May 1986

Aerospace Experience Highlights

- Designed optics for passive IR target tracking with target handover to an active laser tracking telescope.
- Developed electro-optics simulations for nanoradian target tracking and beam pointing.
- Developed a *Kalman filter* for multiple target tracking with nested loop feedback control.
- Derived a unique high-order Zernike based feedback controller for MEMS deformable mirrors in adaptive optics.
- Design of a unique wavelet theory based Eigen value tracking feedback controller of time varying resonant frequency response with respect to excitation level power spectrum for non-linear systems.
- Designed dynamic optical alignment relay for target handover from IR telescope to UV laser telescope.
- Developed aimpoint determination image processing algorithms for extended source IR targets.
- Derived Doppler radar diffraction generated signature models for spinning and coning targets using a derived rotating object quaternion algorithm.
- Performed R&D experiments to produce a new space shuttle tile material that was lighter, stronger, and lower in thermal conductivity than currently manufactured tiles.

Publications and Achievement Awards

- Received an award from the Canadian Foundation for the Development of Microscopy (CFDM) presented at the Microscopy & Microanalysis (M&M) Conference in Portland, Aug 2010.
- M.J. Fryer, B.D. Sawicka, P.B. Jacquemin, C.M. Ludgate, P. Howard, W. Beckman, B. Nelson, R.A. Herring, "Cancer Diagnosis, Treatment, and its Monitoring using an Acoustic Confocal Holography Microscope", Proc. Canadian Society of Mechanical Engineers (CSME) Forum, Victoria, Canada, June 2010.
- P.B. Jacquemin and R. A. Herring, "PID Controller Issues with the CSLH Microscope", CSME Forum, 06-2010.
- P.B. Jacquemin, "A Confocal Scanning Laser Holography (CSLH) Microscope to Non-Intrusively Measure the Three-Dimensional Temperature and Composition of a Fluid". University of Victoria PhD Thesis, May 2010 <http://dspace.library.uvic.ca:8080/handle/1828/3127>.
- P. Jacquemin, D. Laurin, S. Atalick, R. McLeod, S. Lai and R. A. Herring, "Non-Intrusive, Three-Dimensional Temperature and Compositional Measurements Inside Fluid Cells in Microgravity Using a Confocal Holography Microscope", Acta-Astronautica, Volume 60, Issues 8-9, pages 723-727, April-May 2007.
- P. Jacquemin, R. McLeod, D. Laurin, S. Lai and R.A. Herring, "Design of a Confocal Holography Microscope for Three-Dimensional Temperature and Compositional Measurement of Fluids in Microgravity", Microgravity Science and Technology, Volume XVII-4, page 36, June 2005.
- R.A. McLeod, P. Jacquemin, S. Lai and R.A. Herring, "Confocal Holography: Improved Resolution through Object Scanning", Microsc Microanal 11 (Suppl 2), pages 784-785, 2005.
- R.A. Herring, P.B. Jacquemin, B.D. Sawicki, S. Atalick, "Developing a Confocal Acoustic Holography Microscope for Non-Invasive 3D Temperature and Composition Measurements", Ultramicroscopy Vol. 109, pages 830-836, March 2009, doi:10.1016/j.ultramic.2009.03.027.
- AIAA Theater Missile Defense Technologies Conference paper titled "Aimpoint Determination Image Processing for Homing Seeker Terminal Guidance and Control", March 1992.
- NASA engineering achievement award for controller design of the Space Based Micro-Gravity Crystal Growth Furnace Lab, August 1991.
- SPIE Proceeding Journal, Volume 887 pages 124-128, "Acquisition Tracking and Pointing Concepts and Devices for Space Based Neutral Particle Beam", January 1988.

Software Programming Experience

- Optical system and lens design using *Zemax* software, analysis using *Matlab* software, feedback controller design using *Simulink* software, instrumentation design for experiments using *LabVIEW* software, and *C/C++*.