Lukas Chrostowski

Assistant Professor
Department of Electrical Computer Engineering
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Education

Ph.D. **University of California, Berkeley**
Electrical Engineering, February 2004

Thesis: Optical Injection-Locking of Vertical Cavity Surface Emitting Lasers
Advisor: Prof. Connie Chang-Hasnain

B. Eng. **McGill University**, Montreal, Canada
Electrical Engineering – Honours, 1998

Academic Research Experience

Prof. Connie Chang-Hasnain *Post-Doctoral Researcher, 2004*
U.C. Berkeley, Electrical Engineering *Graduate Student, 1998-2004*

- ⇒ Semiconductor optoelectronics research on vertical cavity lasers, MEMS tunable devices, optical communications – from device design, modeling, fabrication, and characterization to optical analog/digital link modeling and experiments.
- ⇒ First 1.55 um VCSEL injection-locking experiments, achieving a record analog 111 dB/Hz$^{2/3}$ dynamic range and a record resonance frequency (40 GHz), demonstration of robustness of locking technique for un-cooled transmitter applications.
- ⇒ Modeling: VCSEL structures; laser nonlinear dynamic simulations of optical injection-locking, including relative intensity noise, small-signal frequency response, harmonic distortions; digital/analog fiber transmission, bit error rate; optical amplifiers.
- ⇒ Semiconductor material processing: device fabrication, mask design, lithography, chemical and plasma etching, ion implantation, thin film deposition, wafer processing related characterization tools. Served as the super-user of the flip-chip bonder.
- ⇒ Bio-sensing applications: design of a MEMS Fourier-transform interferometer system; tunable optical filters.
- ⇒ CMOS optical interconnects using VCSELs
- ⇒ Participated in proposal writing for several NSF and DARPA grants.

Prof. David Plant, Photonic Systems Group *Undergraduate and postgraduate*
McGill University, Electrical Engineering *researcher, 1997-1998*

- ⇒ Free-space optical interconnect project: digital hardware design and high-speed printed circuit board layout; optical detector characterization.

Teaching Experience

University of California, Berkeley, Department of Electrical Engineering

Lecturer

Lightwave Communication Systems (Graduate level), Fall 2003

Teaching Assistant

Electromagnetic Fields and Waves (Upper division), Fall 2000
Semiconductor Electronics (Upper division), Fall 2002

Peer-Reviewed Journal Publications

P. C. Ku, L. Chrostowski, and C. J. Chang-Hasnain, "Low Vpi Mach-Zehnder Modulator using Electromagnetically Induced Transparancy," (manuscript in preparation) *IEE Electronics Letters*, 2004.

X. Zhao, M. Moewe, L. Chrostowski, C.-H. Chang, R. Shau, M. Ortsiefer, M.-C. Amann, and C. J. Chang-Hasnain, "28 GHz Optical Injection Locked 1.55 um VCSELs," (accepted for publication) *IEE Electronics Letters*, 2004.

L. Chrostowski, C. H. Chang, and C. J. Chang-Hasnain, "Injection-Locked 1.55 um Tunable VCSEL for Uncooled WDM Transmitter Applications," *IEEE Photonics Technology Letters*, vol. 16, pp. 888-90, 2004.

C. H. Chang, L. Chrostowski, and C. J. Chang-Hasnain, "Injection Locking of VCSELs," *IEEE Journal of Selected Topics in Quantum Electronics*, September/October 2003.

L. Chrostowski, C. Chih-Hao, and C. J. Chang-Hasnain, "Enhancement of dynamic range in 1.55-um VCSELs using injection locking," *IEEE Photonics Technology Letters*, vol. 15, pp. 498-500, 2003.

L. Chrostowski, C. H. Chang, and C. J. Chang-Hasnain, "Injection-locked 1.55 um VCSELs with enhanced spur-free dynamic range," *Electronics Letters*, vol. 38, pp. 965-7, 2002.

L. Chrostowski, C. Chih-Hao, R. Stone, and C. J. Chang-Hasnain, "Demonstration of long-wavelength directly modulated VCSEL transmission using SOAs," *IEEE Photonics Technology Letters*, vol. 14, pp. 1369-71, 2002.

C. H. Chang, L. Chrostowski, C. J. Chang-Hasnain, and W. W. Chow, "Study of long-wavelength VCSEL-VCSEL injection locking for 2.5-Gb/s transmission," *IEEE Photonics Technology Letters*, vol. 14, pp. 1635-7, 2002.

W. W. Chow, H. C. Schneider, S. W. Koch, C. Chih-Hao, L. Chrostowski, and C. J. Chang-Hasnain, "Nonequilibrium model for semiconductor laser modulation response," *IEEE Journal of Quantum Electronics*, vol. 38, pp. 402-9, 2002.

C. F. R. Mateus, C. Chih-Hao, L. Chrostowski, S. Yang, S. Decai, R. Pathak, and C. J. Chang-Hasnain, "Widely tunable torsional optical filter," *IEEE Photonics Technology Letters*, vol. 14, pp. 819-21, 2002.

C. H. Chang, L. Chrostowski, and C. J. Chang-Hasnain, "Parasitics and design considerations on oxide-implant VCSELs," *IEEE Photonics Technology Letters*, vol. 13, pp. 1274-6, 2001.

Invited Conference Proceedings

L. Chrostowski, C.-H. Chang, C. Chang-Hasnain, "High speed enhancement of directly-modulated VCSELs by injection locking," presented at *Vertical-Cavity Surface-Emitting Lasers VIII, SPIE*, 2004 (**Invited**).

C. H. Chang, L. Chrostowski, and C. Chang-Hasnain, "Enhanced VCSEL Performance by Optical Injection Locking for Analog and Digital Applications," presented at *Laser and Electro Optic Society*, Tucson, AZ, 2003 (**Invited**).

C. H. Chang, L. Chrostowski, and C. J. Chang-Hasnain, "Injection-locked 1.55 um VCSELs in analog and digital communication systems," *LEOS Summer Topical Meetings*, Quebec, Canada, TuD2, 2002 (**Invited**).

Conference Proceedings

L. Chrostowski, P. Bala Subrahmanyam, Y. Zhou, C. J. Chang-Hasnain, "VCSEL Tolerance to Optical Feedback for Inter-chip Optical Interconnects," submitted to *IEEE International Semiconductor Laser Conference*, 2004.

L. Chrostowski, W. Zhao, C. Chang-Hasnain, R. Shau, M. Ortsiefer and M.-C. Amann, "40 GHz Resonance Frequency of a 1.55 um Injection-Locked VCSEL," (manuscript in preparation) *International Topical Meeting on Microwave Photonics*, 2004.

P. C. Ku, L. Chrostowski, and C. J. Chang-Hasnain, "Mach-Zehnder Modulator using Electromagnetically Induced Transparancy," (manuscript in preparation) *International Topical Meeting on Microwave Photonics*, 2004.

L. Chrostowski, M. Moewe, W. Zhao, C.-H. Chang, C. Chang-Hasnain, R. Shau, M. Ortsiefer and M.-C. Amann, "39 GHz Intrinsic Bandwidth of a 1.55 um Injection-Locked VCSEL," to be presented at the *Conference on Lasers and Electro-Optics*, 2004.

C. H. Chang, L. Chrostowski, and C. J. Chang-Hasnain, "23 GHz injection-locked 1.55 um VCSEL," presented at the *Optical Fiber Conference*, 2004.

L. Chrostowski, C. H. Chang, and C. Chang-Hasnain, "Reduction of Relative Intensity Noise and Improvement of Spur-Free Dynamic Range of an Injection Locked VCSEL," presented at *Laser and Electro Optic Society*, Tucson, AZ, 2003

L. Chrostowski, C. H. Chang, R. Stone, and C. J. Chang-Hasnain, "Uncooled Injection-Locked 1.55 um Tunable VCSEL as WDM Transmitter," presented at *Optical Fiber Communications Conference*, 2003.

C. H. Chang, L. Chrostowski, and C. Chang-Hasnain, "Frequency Response Enhancement of Injection-Locked Lasers," *Conference on Lasers and Electro-Optics*, 2003.

C. H. Chang, L. Chrostowski, and C. J. Chang-Hasnain, "Analog modulation dynamic range enhancement using injection-locked 1.55 um VCSELs," *IEEE International Semiconductor Laser Conference*, pp.117-18, 2002.

C. H. Chang, L. Chrostowski, and C. J. Chang-Hasnain, "Transmission improvement of VCSEL at 2.5Gb/s under injection locking by another VCSEL," *IEEE Lasers and Electro-Optics Society*, vol. 2, pp.728-9, 2001.

L. Chrostowski, C. H. Chang, R. J. Stone, and C. Chang-Hasnain, "Study of long-wavelength directly modulated VCSEL transmission using SOA amplifiers," poster at *European Conference on Optical Communication*, vol.3, pp.432-3, 2001.

C. H. Chang, L. Chrostowski, and C. J. Chang-Hasnain, "Parasitics and design considerations on oxide-implant VCSELs," 17th *International Semiconductor Laser Conference*, pp.95-6, 2000.

Academic Awards and Distinctions

OSA New Focus/Bookham Student Award finalist	2004
U.C. Berkeley, EECS Department, Demetri Angelakos Memorial Award	2004
Natural Sciences and Engineering Research Council of Canada (**NSERC**) Post Graduate Scholarship	1999 to 2001
University Scholars of Canada Award	1998
Distinction, McGill University Ranked 3rd in graduating class	1998
McConnell Award, McGill University	1997
Canada Scholarship	1994 to 1998
Hugh Brock McGill Entrance Scholarship	1994 to 1998
McGill Engineering Dean's Honour List	1994 to 1998
NSERC Industrial undergraduate student research award	1996
Highest academic standing, St. Matthew High School graduating class	1994

Industry Experience

MPB Technologies, Canada *Summer 1996*
Communications Division

⇒ Debugging and testing of high-speed (SDH/PDH) telecommunications hardware.
⇒ Designed test procedure and wrote automated testing software.

Electrical Engineering Department, Dr. B Kaminska *Part-time 1995-1996*
Polytechnique de Montreal, Canada

⇒ Programmed a graphical interface for a VLSI analysis software. Software written in C using Motif.

Oprel Technologies, Dr. Andrew Hatko *Summer 1995*
Ottawa, Ontario

⇒ Created software for Erbium-Doped Fiber Amplifier (EDFA) characterization. Assisted in the design and development of such amplifiers.

IEEE Canada *Part-time 1994-2001*

⇒ System administration of the Unix and NT computers; design of the local network and Internet services; design of an online Oracle database.

HC Data Systems Inc. *Summer 1995*

⇒ Wrote software for a video conferencing aid in a tele-medicine application.

Computer Skills

Electrical Engineering software tools: Cadence, Mentor Graphics (Design Architect, Digital Simulations, High-Speed Layout), Spice, MatLab, Mathcad, Logic Works.
Programming in C, LabView, FORTRAN, Visual Basic, Pascal.

Extra Curricular Activities

Organizational

⇒ Maintenance manager (2000), work-shift manager (2001-2002) at a student housing cooperative (University Students Cooperative Association)
⇒ Engineering representative to the McGill Academic Senate and executive of the McGill Engineering Undergraduate Society (1997-98)
⇒ President of McGill Electrical Engineering Society (1996-97)
⇒ Class representative to the student council (1995-96)
⇒ Organizer of National Engineering Week at McGill University (1996)

Personal

⇒ Climbed Mt. McKinley and Huascaran (tallest peaks in N. America and Peru, respectively); skiing; long-distance cycling.
⇒ Photography, Vipassana Meditation

Professional Affiliations

Institute of Electrical and Electronics Engineers (IEEE)
Lasers and Electro-Optics Society (LEOS), Optical Society of America (OSA)

References

1. *Professor Connie Chang-Hasnain*
   University of California, Berkeley
   Department of Electrical Engineering and Computer Science, Berkeley, CA
   510-642-4315, cch@eecs.berkeley.edu

2. *Professor David V. Plant*
   McGill University
   Department of Electrical and Computer Engineering, Montreal, Quebec, Canada
   514-398-2989, plant@photonics.ece.mcgill.ca

3. *Professor Kam Y. Lau*
   University of California, Berkeley
   Department of Electrical Engineering and Computer Science, Berkeley, CA
   408-321-0168, klau@eecs.berkeley.edu

4. *Professor Roger T. Howe*
   Professor and Associate Chair
   University of California, Berkeley
   Department of Electrical Engineering and Computer Science, Berkeley, CA
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5. *Dr. Robert J. Stone*
   Infinera Corporation
   408-572-5200
   rstone@infinera.com