

**FACULTY
RESEARCH STAFF &
PUBLICATIONS**



Akintunde I. (Tayo) Akinwande

Professor

Department of Electrical Engineering and Computer Science

COLLABORATORS

M. Martinez-Sanchez, MIT
V. Bulovic, MIT
H.I. Smith, MIT
M.A. Schmidt, MIT
B.E. Gnade, UT Dallas
A.A. Seshia, University of Cambridge

POSTDOCTORAL ASSOCIATES

Y.W. Choi, MIT
L.F. Velasquez-Garcia, MIT

GRADUATE STUDENTS

L.-Y. Chen, Res. Asst., EECS
G. Sha, Res. Asst., Physics
J. Walker, Res. Asst., EECS
A.I. Wang, Res. Asst., EECS
L. Lebel, Res. Asst., AA

SUPPORT STAFF

C. Collins, Admin. Asst. II

PUBLICATIONS

I. Kymissis and A.I. Akinwande, "Organic field emission device integrated with organic transistor," *IEEE Transactions on Electron Devices*, vol. 52, no. 8, pp. 1907-1914, Aug. 2005.

C.-Y. Hong and A.I. Akinwande, "Oxidation sharpening mechanism for silicon tip formation," *Electrochemical and Solid-State Letters*, vol. 8, no. 5, pp. F13-F15, Apr. 2005.

I. Kymissis, C.G. Sodini, A.I. Akinwande, and V. Bulovic, "An organic semiconductor based process for photodetecting applications," *IEEE International Electron Device Meeting Technical Digest*, Dec. 2004, pp. 377-380.

A.I. Wang, I. Kymissis, V. Bulovic, and A.I. Akinwande, "Process control of threshold voltage in organic FETs," *IEEE International Electron Device Meeting Technical Digest*, Dec. 2004, pp. 381-384.

I.-D. Kim, Y.W. Choi, A.I. Akinwande, and H.L. Tuller, "Novel laser transfer method for flexible electronic, photonic, and MEMS application," presented at *Materials Research Society Fall Meeting*, 2004.

L.F. Velásquez-Garcia, A.I. Akinwande, and M. Martinez-Sanchez, "Advances in micro-fabricated droplet emission mode 1D colloid thruster array," in *Proc. 4th International Spacecraft Propulsion Conference*, Cagliari, Italy, June 2004, p. 30.

Y.W. Choi, J.S. Park, I. Kymissis, A.I. Wang, R.G. Gordon, and A.I. Akinwande, "Pentacene organic TFT with Al₂O₃ gate dielectric deposited using atomic layer deposition method," presented at *Materials Research Society Spring Meeting*, 2004.

I. Kymissis, C.G. Sodini, A.I. Akinwande, and V. Bulovic, "A process for integrated organic photodetection," presented at *SPIE Photonics West*, 2004.

L.-Y. Chen and A.I. Akinwande, "Double-gated silicon field emission arrays: fabrication and characterization," in *17th International Vacuum Nanoelectronics Conference Technical Digest*, Cambridge, MA, July 2004, pp. 200-201.

L.F. Velasquez, A.I. Akinwande, and M. Martinez-Sanchez, "Two-dimensional micro-fabricated colloid thruster array," presented at the *40th AIAA/ASME/SAE/ASEE Joint Propulsion Conference and Exhibit*, 2004.

Dimitri A. Antoniadis

Ray and Maria Stata Professor of Electrical Engineering
Department of Electrical Engineering and Computer Science

COLLABORATORS

R. Lei, Intel
M. Lee, MIT

GRADUATE STUDENTS

J. Hennessy, Res. Asst., EECS
A. Khakifirooz, Res. Asst., EECS
J-K. Lee, Res. Asst., EECS
O. Nayfeh, Res. Asst., EECS
A. Ritenour, Res. Asst., EECS

SUPPORT STAFF

M. Hudak, Admin. Asst. II

PUBLICATIONS

A. Khakifirooz and D.A. Antoniadis, "Scalability of hole mobility enhancement in biaxially strained ultrathin body SOI," *IEEE Electron Device Letters*, vol. 27, no. 5, pp. 402-404, May 2006.

A. Ritenour, A. Khakifirooz, D.A. Antoniadis, R.Z. Lei, W. Tsai, A. Dimoulas, G. Mavrou, and Y. Panayiotatos, "Subnanometer-equivalent-oxide-thickness germanium p-MOS field-effect-transistors fabricated using molecular-beam-deposited high- κ /metal gate stack," *Applied Physics Letters*, vol. 88, p. 132107:1-3, Mar. 2006.

W.P. Bai, N. Lu, A. Ritenour, M.L. Lee, D.A. Antoniadis, and D.L. Kwong, "Ge n-MOSFETs on lightly doped substrates with high- κ dielectric and TaN gate," *IEEE Electron Device Letters*, vol. 27, no. 3, pp. 175-178, Mar. 2006.

R.Z. Lei, W. Tsai, I. Åberg, T.B. O'Reilly, J.L. Hoyt, D.A. Antoniadis, H.I. Smith, A.J. Paul, M.L. Green, J. Li, and R. Hull, "Strain relaxation in patterned strained silicon directly on insulator structures," *Applied Physics Letters*, vol. 87, pp. 251926:1-3, Dec. 2005.

M.A. Rahman, T. Osipowicz, K.L. Pey, L.J. Lin, W.K. Choi, D.Z. Chi, D.A. Antoniadis, E.A. Fitzgerald, and D.M. Isaacson, "Suppression of oxidation in nickel germanosilicides by Pt incorporation," *Applied Physics Letters*, vol. 87, pp. 182116:1-3, Oct. 2005.

I. Åberg, T.A. Langdo, Z.-Y. Cheng, A. Lochtefeld, I. Lauer, D.A. Antoniadis, and J.L. Hoyt, "Transport and leakage in super-critical thickness strained silicon on insulator MOSFETs with strained Si thickness up to 135 nm," in *Proc. IEEE SOI Conference*, Honolulu, HI, Oct. 2005, pp. 24-26.

L.J. Jin, K.L. Pey, W.K. Choi, E.A. Fitzgerald, D.A. Antoniadis, A.J. Pitera, M.L. Lee, D.Z. Chi, M.A. Rahman, T. Osipowicz, and C.H. Tung, "Effect of Pt on agglomeration and Ge out diffusion in Ni(Pt) germanosilicide," *Journal of Applied Physics*, vol. 98, pp. 033520: 1-6, Aug. 2005.

B.H. Koh, E.W.H. Kan, W.K. Chim, W.K. Choi, D.A. Antoniadis, and E.A. Fitzgerald, "Traps in germanium nanocrystal memory and effect on charge retention: Modeling and experimental measurements," *Journal of Applied Physics*, vol. 97, pp. 124305:1-9, June 2005.

I. Lauer and D.A. Antoniadis "Enhancement of electron mobility in ultrathin-body silicon-on-insulator MOSFETs with uniaxial strain," *IEEE Electron Device Letters*, vol. 26, no. 5, pp. 314-316, May 2005.

L.J. Jin, K.L. Pey, W.K. Choi, E.A. Fitzgerald, D.A. Antoniadis, A.J. Pitera, M.L. Lee, and C.H. Tung, "Highly oriented Ni(Pd)SiGe formation at 400°C," *Journal of Applied Physics*, vol. 97, pp. 104917: 1-5, May 2005.

H.M. Nayfeh, J.L. Hoyt, and D.A. Antoniadis, "A physically based analytical model for the threshold voltage of strained- Si n-MOSFETs," *IEEE Transactions on Electron Devices*, vol. 51, no. 12, pp. 2069-2072, Dec. 2004.

G. Xia, H.M. Nayfeh, M.L. Lee, E.A. Fitzgerald, D.A. Antoniadis, D.H. Anjum, J. Li, R. Hull, N. Klymko, and J.L. Hoyt, "Impact of ion implantation damage and thermal budget on mobility enhancement in strained-Si N-channel MOSFETs," *IEEE Transactions on Electron Devices*, vol. 51, no. 12, pp. 2136-2144, Dec. 2004.

J. Jung, S. Yu, M. L. Lee, J.L. Hoyt, E.A. Fitzgerald, and D.A. Antoniadis, "Mobility Enhancement in Dual-channel p-MOSFETs," *IEEE Transactions on Electron Devices*, vol. 51, no. 9, pp. 1424-1431, Sept. 2004.

Marc Baldo

Assistant Professor

Department of Electrical Engineering and Computer Science

COLLABORATORS

J. Shinar, Iowa State University
Z. Soos, Princeton University
B.D. Bruce, University of Tennessee,
Knoxville
N. Lebedev, Naval Research
Laboratory
M. Singh, MIT

GRADUATE STUDENTS

M. Segal, Res. Asst., EECS
J. Mapel, Res. Asst., EECS
K. Milaninia, Res. Asst., MSE
B.N. Limketkai, Res. Asst., EECS
M. Bora, Res. Asst., Physics
K. Celabi, Res. Asst., Physics
T. Heidel, Res. Asst., EECS
M. Currie, Res. Asst., EECS

SUPPORT STAFF

E. Moran, Admin. Asst. I

PUBLICATIONS

P. Kiley, X. Zhao, M. Vaughn, M.A. Baldo, B.D. Bruce, and S. Zhang, "Self-assembling peptide detergents stabilize isolated photosystem I on a dry surface for an extended time," *Public Library of Science (PLoS) Biology*, vol. 3, no. 7, pp.1180-1186, July 2005.

M. Segal, M.A. Baldo, M.K. Lee, J. Shinar and Z.G. Soos, "The frequency response and origin of the spin-1/2 photoluminescence-detected magnetic resonance in a pi-conjugated polymer," *Physical Review B*, vol. 71, no. 24, pp. 245201: 1-11, June 2005.

M.A. Baldo and M. Segal, "Phosphorescence as a probe of exciton formation and energy transfer in organic light emitting diodes," *physica status solidi (a)*, vol. 201, no. 6, pp. 1205-1214, May 2004.

R. Das, P.J. Kiley, M. Segal, J. Norville, A.A. Yu, L. Wang, S. Trammell, L.E. Reddick, R. Kumar, S. Zhang, F. Stellacci, N. Lebedev, J. Schnur, B.D. Bruce, and M.A. Baldo, "Solid state integration of photosynthetic protein molecular complexes," *Nano Letters*, vol. 4, no. 6, pp. 1079-1083, May 2004.

M.K. Lee, M. Segal, Z.G. Soos, J. Shinar, and M.A. Baldo, "Yield of singlet excitons in organic light-emitting devices: A double modulation photoluminescence-detected magnetic resonance study," *Physical Review Letters*, vol. 94, no. 13, 137403, Apr. 2005.

B.N. Limketkai and M.A. Baldo, "Charge injection into cathode-doped amorphous organic semiconductors," *Physical Review B*, vol. 71, no. 8, pp. 085207: 1-9, Feb. 2005.

M. Segal and M.A. Baldo, "Reverse bias measurements of the photoluminescent efficiency of semiconducting organic thin films," *Organic Electronics*, vol. 4, no. 3, pp. 191-197, 2003.

M. Segal, M.A. Baldo, R.J. Holmes, S.R. Forrest and Z.G. Soos, "Excitonic singlet-triplet ratios in molecular and polymeric organic materials," *Physical Review B*, vol. 68, no. 7, pp. 075211: 1-14, Aug. 2003.

George Barbastathis

Associate Professor

Department of Mechanical Engineering

COLLABORATORS

E. Demaine, MIT
E. Ippen, MIT
F. Kaertner, MIT
S.-G. Kim, MIT
C. Livermore, MIT
J. Milgram, MIT
D. Pucci de Farias, MIT
Y. Shao-Horn, MIT
H.I. Smith, MIT
H.L. Tuller, MIT
J. Barton, University of Arizona
R.K. Kostuk, University of Arizona
M.A. Neifeld, University of Arizona
D. Psaltis, Caltech

GRADUATE STUDENTS

N. Shaar, Res. Asst., ME
W. Arora, Res. Asst., EECS
L. Waller, Res. Asst., EECS
A.J. Nichol, Res. Asst., ME
S. Oh, Res. Asst., ME
P. Stellman, Res. Asst., ME
H.J. In, Res. Asst., ME
J. Dominguez-Caballero, Res. Asst., ME
S. Takahashi, Res. Asst., ME

SUPPORT STAFF

N. Hanafin, Admin. Asst. II

PUBLICATIONS

W.J. Arora, A.J. Nichol, H.I. Smith, and G. Barbastathis, "Membrane folding to achieve 3-D nanostructures: Nanopatterned silicon nitride folded with stressed chromium hinges," *Applied Physics Letters*, vol. 88, pp. 053108: 1-3, Jan. 2006.

K. Tian, T. Cuingnet, Z. Li, W. Liu, D. Psaltis, and G. Barbastathis, "Diffraction from deformed volume holograms: Perturbation theory approach," *Journal of the Optical Society of America A*, vol. 22, no. 12, pp. 2880-2889, Dec. 2005.

K. Tian, G. Barbastathis, and J.H. Hong, "Localized guided propagation modes in photonic crystals with shear discontinuities," in *Proc. 5th IEEE Conference on Nanotechnology*, Nagoya, Japan, July 2005, pp. 31-34.

W. Sun, G. Barbastathis, and M.A. Neifeld, "High-resolution volume holographic profilometry using the Viterbi algorithm," *Optics Letters*, vol. 30, no. 11, pp. 1297-1299, June 2005.

G.N. Nielson, D. Seneviratne, F. Lopez-Royo, P. Rakich, M.R. Watts, H.A. Haus, H.L. Tuller, and G. Barbastathis, "Integrated wavelength-selective optical MEMS switching using ring resonator filters," *IEEE Photonics Technology Letters*, vol. 17, no. 6, pp. 1190-1192, June 2005.

G. Barbastathis, "Imaging properties of three-dimensional pupils," presented at *OSA Topical Meeting on Computational Optical Sensing and Imaging*, 2005.

Z. Xu, K. Tian, W. Sun, G. Barbastathis, and M.A. Neifeld, "Rigorous analysis of strong spherical wave gratings using a slice-and-cascade approach," presented at *OSA Topical Meeting on Information Photonics*, 2005.

Z. Xu, W. Sun, K. Tian, and G. Barbastathis, "Numerical simulation of hyper-spectral volume holographic imaging using slice-and-cascade method," presented at *OSA Topical Meeting on Information Photonics*, 2005.

W. Sun and G. Barbastathis, "Rainbow volume holographic imaging," *Optics Letters*, vol. 30, no. 9, pp. 976-978, May 2005.

W. Sun, G. Barbastathis, and M.A. Neifeld, "Maximum-likelihood surface reconstruction with Viterbi algorithm for volume holographic profilometry," presented at *Conference on Lasers and Electro-Optics (CLEO/QELS)*, 2005.

W. Sun, K. Tian, and G. Barbastathis, "Hyper-spectral imaging with volume holographic lenses," presented at *CLEO/QELS*, 2005.

K. Tian, Z. Li, T. Cuingnet, W. Liu, and D. Psaltis, "Diffraction from arbitrarily deformed volume holograms," presented at *CLEO/QELS*, 2005.

H.J. In, W.J. Arora, H.I. Smith, and G. Barbastathis, "The nanostructured Origami 3D fabrication and assembly process for nanopatterned 3D structures," in *Proc. SPIE Smart Structures and Materials*, San Diego, CA, May 2005, pp. 84-95.

R. Menon, D. Gil, G. Barbastathis, and H.I. Smith, "Photon-sieve lithography," *Journal of the Optical Society of America A*, vol. 22, no. 2, pp. 342-345, Feb. 2005.

Karl K. Berggren

Assistant Professor

Department of Electrical Engineering and Computer Science

COLLABORATORS

A. Abouraddy, MIT
S. Harrer, TUM.
A.J. Kerman, Lincoln Laboratory
S.-W. Nam, NIST
T. Orlando, MIT
J. Stern, JPL
J. Thywissen, U. of Toronto

POSTDOCTORAL STUDENTS

K. Rosfjord, EECS

GRADUATE STUDENTS

V. Anant, Res. Asst., EECS
B. Cord, Res. Asst., EECS
E. Dauler, Res. Asst., EECS
J. Leu, Res. Asst., EECS
D. Sanchez, Res. Asst., EECS
J. Yang, Res. Asst., EECS

UNDERGRADUATE STUDENTS

Y. Ma, UROP
A. Chao, UROP

VISITING STUDENTS

D. Masciarelli, Polytechnic of Turin
G. Salvatore, Polytechnic of Turin

SUPPORT STAFF

T. Kuhn, Admin. Asst.
J. Daley, Project Technician
M. Mondol, Facility Manager, SEBL

PUBLICATIONS

A.J. Kerman, E.A. Dauler, W.E. Keicher, J.K.W. Yang, K.K. Berggren, G.N. Goltsman, and B.M. Voronov, "Kinetic-inductance-limited reset time of superconducting nanowire photon counters," *Applied Physics Letters*, no. 88, pp. 111116: 1-3, Mar. 2006.

B. Robinson, A. Kerman, E. Dauler, R. Barron, D. Caplan, M. Stevens, J. Carney, S. Hamilton, J. Yang and K.K. Berggren, "781-Mbit/s photon-counting optical communications using a superconducting nanowire detector," *Optics Letters*, vol. 31, no. 4, pp. 444-446, Feb. 2006.

K.M. Rosfjord, J.K.W. Yang, E.A. Dauler, A.J. Kerman, V. Anant, B.M. Voronov, G.N. Gol'tsman, and K.K. Berggren "Nanowire single-photon detector with an integrated optical cavity and anti-reflection coating," *Optics Express*, vol. 14, no. 2, pp. 527-534, Jan. 2006.

W.D. Oliver, Y. Yu, J.C. Lee, K.K. Berggren, L.S. Levitov, and T.P. Orlando, "Mach-Zehnder interferometry in a strongly driven superconducting Qubit," *Science*, vol. 310, pp. 1653-1657, Dec. 2005.

V. Anant, M. Radmark, A.F. Abouraddy, T.C. Killian, and K.K. Berggren, "Pumped quantum systems: Immersion fluids of the future," *Journal of Vacuum Science & Technology B*, vol. 23, no. 6, pp. 2662-2667, Nov. 2005.

J.K.W. Yang, E. Dauler, A. Ferri, A. Pearlman, A. Verevkin, G. Goltsman, B. Voronov, R. Sobolewski, W.E. Keicher, and K.K. Berggren, "Fabrication development for nanowire GHz-counting-rate single-photon detectors," *IEEE Transactions on Applied Superconductivity*, vol. 15, no. 2, part 1, pp. 626-630, June 2005.

Y. Yu, W.D. Oliver, J.C. Lee, K.K. Berggren, and T. P. Orlando, "Energy relaxation times in Nb persistent current qubits," *IEEE Trans. Appl. Supercond*, vol. 15, no. 2, part 1, pp. 845-848, June 2005.

J.C. Lee, W.D. Oliver, T.P. Orlando, and K.K. Berggren, "Resonant readout of a persistent current qubit," *IEEE Trans. Appl. Supercond*, vol. 15, no. 2, part 1, pp. 841-844, June 2005.

Sangeeta N. Bhatia

Associate Professor

Harvard-MIT Division of Health Sciences & Technology

Department of Electrical Engineering and Computer Science

COLLABORATORS

J. Chen, MIT
C. Chen, UPenn
S. Chien, UCSD
F. Gage, Salk Institute
B. Imperiali, MIT
R. Johnson, UCSD
L. Mahadevan, Harvard University
D. Melton, Harvard University
M. Mrksich, University of Chicago
B. Ranscht, Burnham Institute
E. Ruoslahti, Burnham Institute
R. Sah, UCSD
M. Sailor, UCSD
R. Sasisekharan, MIT
J. Shah, HMS
P. Sharp, MIT
S. Suresh, MIT
K. Van Vliet, MIT
R. Weissleder, HMS
J. West, Rice University

GRADUATE STUDENTS

A. Chen, Res. Asst., HST
T. Harris, Res. Asst., HST
G. von Maltzahn, Res. Asst., HST
S. Mittal, Res. Asst., EECS
C. Flaim, Res. Asst., UCSD
Bioengineering
A. Derfus, Res. Asst., UCSD
Bioengineering

SUPPORT STAFF

S. Kangiser, Admin. Asst. II
K. Hudson, Laboratory Manager
M. Akiyama-Gutierrez, Technical Assistant

PUBLICATIONS

D.R. Albrecht, G.H. Underhill, T.B. Wassermann, R.L. Sah, and S.N. Bhatia, "Probing the role of multicellular organization in 3D microenvironments," *Nature Methods*, vol. 3, pp. 369-375, Apr. 2006.

T.J. Harris, G. von Maltzahn, A.M. Derfus, E. Ruoslahti, and S.N. Bhatia, "Proteolytic actuation of nanoparticle self-assembly," *Angewandte Chemie International Edition*, vol. 41, no. 19, pp. 3161-3165, 2006.

J.H. Park, A.M. Derfus, E. Segal, K.S. Vecchio, S.N. Bhatia, and M.J. Sailor, "Local heating of discrete droplets using magnetic porous silicon-based photonic crystals," *Journal of the American Chemical Society*, 2006, to be published.

M.P. Schwartz, A.M. Derfus, S.D. Alvarez, S.N. Bhatia, and M.J. Sailor, "The smart petri dish: A nanostructured photonic crystal for real-time monitoring of living cells," *Langmuir*, 2006, to be published.

S.N. Bhatia and T. Desai, Eds., *Volume III Therapeutic Micro/Nanotechnology. Encyclopedia of BioMEMS and Biomedical and Micronanotechnology*, New York: Springer, to be published.

C. Flaim, S. Chien, and S.N. Bhatia, "An extracellular matrix microarray for probing cellular differentiation," *Nature Methods*, vol. 2, no. 2, pp. 119-125, 2005.

A.A. Chen, A.M. Derfus, S.R. Khetani and S.N. Bhatia, "Quantum dots to monitor RNAi delivery and improve gene silencing," *Nucleic Acids Research*, vol. 33, no. 22, p. e190, 2005.

J.W. Allen, S.R. Khetani and S.N. Bhatia, "In vitro zonation and toxicity in a hepatocyte bioreactor," *Toxicological Sciences*, vol. 84, pp. 110-119, Mar. 2005.

D.R. Albrecht, V. Lui Tsang, R.L. Sah and S.N. Bhatia, "Photo-and electropatterning of live cellular arrays within hydrogels," *Lab on a Chip*, vol. 5, no. 1, pp. 111-118, 2005.

J. Dorvee, A.M. Derfus, S.N. Bhatia and M.J. Sailor, "Manipulation of liquid droplets using amphiphilic, magnetic 1-D photonic crystal chaperones," *Nature Materials*, vol. 3, no. 12, pp. 896-899, Dec. 2004.

V. Chin, S. Sanga, P. Taupin, J. Scheel, F.G. Gage, and S.N. Bhatia, "A microfabricated platform for studying stem cell fates," *Biotechnology and Bioengineering*, vol. 88, no. 3, pp. 399-415, Mar. 2004.

D. Albrecht, R. Sah and S.N. Bhatia, "Geometric and material determinants of patterning efficiency by dielectrophoresis," *Biophysical Journal*, vol. 87, no. 4, pp. 2131-2147, Apr. 2004.

V. Liu and S.N. Bhatia, "3D tissue fabrication," *Advanced Drug Delivery*, vol. 56, no. 11, pp. 1635-1647, Nov. 2004.

S.N. Bhatia, "Cell and tissue-based sensors," in *WTEC (World Technology Evaluation Center) Panel Report on International Research and Development in Biosensing*, Aug. 2004, pp. 35-42.

S. Khetani, G. Szulgit, J. Del Rio, C. Barlow and S.N. Bhatia, "Exploring mechanisms of stromal-epithelial cell interactions using gene expression profiling," *Hepatology*, vol. 40, no. 3, pp. 545-554, Aug. 2004.

A. Derfus, W. Chan and S.N. Bhatia, "Intracellular delivery of quantum dots for live cell labeling and organelle tracking," *Advanced Materials*, vol. 16, no. 12, pp. 961-966, June 2004.

A. Derfus, W. Chan, and S.N. Bhatia, "Probing the cytotoxicity of semiconductor quantum dots," *Nanoletters*, vol. 4, no. 1, pp. 11-18, Jan. 2004.

P. Lin, W. Chan, S. Badyrak and S.N. Bhatia, "Assessing liver-derived biomatrix for hepatic tissue engineering," *Tissue Engineering*, vol. 10, no. 7/8, pp. 1046-1053, Jul.-Aug. 2004.

Duane S. Boning

Professor

Department of Electrical Engineering and Computer Science

GRADUATE STUDENTS

K. Abrokwah, Res. Asst., EECS
K. Balakrishnan, Res. Asst., EECS
H. Cai, Res. Asst., MSE
N. Drego, Res. Asst., EECS
K. Gettings, Res. Asst., EECS
D. Lim, Res. Asst., EECS
A. Somani, Res. Asst., MSE
H. Taylor, Res. Asst., EECS
D. Truque, Res. Asst., EECS
X. Xie, Res. Asst., Physics

SUPPORT STAFF

S. Blake, Admin. Asst. II

PUBLICATIONS

A. Somani, S.J. White, D. Boning, P. Gschwend and R. Reif, "Environmental impact evaluation methodology for emerging silicon-based technologies," presented at *IEEE International Symposium on Electronics and the Environment*, San Francisco, CA, May 2006.

K.O. Abrokwah, P.R. Chidambaram, and D.S. Boning, "Pattern based prediction for plasma etch," presented at *17th Annual IEEE/SEMI Advanced Semiconductor Manufacturing Conference*, Boston, MA, Apr. 2006.

D. Boning, "Variation and design for manufacturability in advanced fabrication processes," presented at *6th International Semiconductor Technology Conference*, 2006.

X. Xie, D. Boning, F. Meyer, R. Rzehak, and P. Wagner, "Analysis and modeling of nanotopography impact in blanket and patterned silicon wafer polishing," presented at *11th International Conference on Chemical-Mechanical Planarization for ULSI Multilevel Interconnection*, 2006.

X. Xie, D. Boning, K. Devriendt, and A.S. Lawing, "Modeling of friction evolution during STI CMP as endpoint signals," presented at *11th International Conference on Chemical-Mechanical Planarization for ULSI Multilevel Interconnection*, 2006.

Z. Li, P. Lefevre, I. Koshiyama, K. Ina, D. Boning, and A. Philipossian, "Comparison of copper disc and copper wafer polishing processes in terms of their kinetic, tribological and thermal characteristics," *IEEE Transactions on Semiconductor Manufacturing*, vol. 18, no. 4, pp. 681-687, Nov. 2005.

X. Xie and D. Boning, "Relating friction in CMP to topography evolution," in *Proc. World Tribology Congress III*, Washington, DC, Sept. 2005, pp. 64115: 1-2.

Y. Sampurno, L. Borucki, Y. Zhuang, D. Boning, and A. Philipossian, "A method for direct measurement of substrate temperature during copper CMP," *Journal of the Electrochemical Society*, vol. 152, no. 7, pp. G537-G541, July 2005.

B.D. Tang, X. Xie, and D. Boning, "Damascene chemical-mechanical polishing characterization and modeling for polysilicon microelectromechanical systems structures," *Journal of the Electrochemical Society*, vol. 152, no. 7, pp. G582-G587, July 2005.

V. Michael Bove, Jr.
Principal Research Scientist
Media Arts and Sciences Program/Media Laboratory

COLLABORATORS

W.J. Plesniak, Brigham and Women's
Hospital

POSTDOCTORAL ASSOCIATES

Q. Smithwick, Media Lab

GRADUATE STUDENTS

J. Barabas, Res. Asst., MAS
D. Hirsh, Res. Asst., MAS
J. Kalanithi, Res. Asst., MAS
D. Smalley, Res. Asst., EECS

SUPPORT STAFF

K. Hall, Admin. Asst. II

PUBLICATIONS

S.A. Benton and V.M. Bove, Jr.,
Holographic Imaging, New York: John
Wiley & Sons, Inc., to be published.

W. Plesniak, M. Halle, V.M. Bove,
Jr., J. Barabas, and R. Pappu,
"Reconfigurable image projection
(RIP) holograms," *Optical Engineering*,
to be published.

D. Butler, V.M. Bove, Jr., and S.
Sridharan, "Real-time adaptive
foreground/background
segmentation," *EURASIP Journal on
Applied Signal Processing*, vol. 14, no. 11,
pp. 2292-2304, Aug. 2005.

B.C. Dalton and V.M. Bove, Jr., "Audio-
based self-localization for ubiquitous
sensor networks," presented at *118th
Audio Engineering Society Convention*,
2005.

V.M. Bove, Jr., W.J. Plesniak, T.
Quentmeyer, and J. Barabas, "Real-
time holographic video images with
commodity PC hardware," in *Proc.
SPIE Stereoscopic Displays and Applications*,
San Jose, CA, Mar. 2005, pp. 255-
262.

Vladimir Bulović

Associate Professor

Department of Electrical Engineering and Computer Science

RESEARCH STAFF

I. Kymissis, Postdoctoral Associate

COLLABORATORS

T. Akinwande, MIT
M. Baldo, MIT
M. Bawendi, MIT
P. Benning, HP
P. Mardilovich, HP
A. Nurmikko, Brown Univ.
D. Schut, HP
M. Schmidt, MIT
C.G. Sodini, MIT
T. Swager, MIT

GRADUATE STUDENTS

P.O. Anikeeva, Res. Asst. DMSE
A.C. Arango, Res. Asst. EECS
S. Bradley, Res. Asst. EECS
J. Chen, Res. Asst. DMSE
S.A. Coe-Sullivan, Res. Asst. EECS
J. Ho, Res. Asst. EECS
E. Howe, Res. Asst. Physics
L. Kim, Res. Asst. EECS
J. Leu, Res. Asst. EECS
C.F. Madigan, Res. Asst. EECS
I. Nausieda, Res. Asst. EECS
M. Randolph, Res. Asst. DMSE
R. Tabone, Res. Asst. EECS
J.R. Tischler, Res. Asst. EECS
V. Wood, Res. Asst. EECS
J. Yu, Res. Asst. EECS

SUPPORT STAFF

A. Glass, Admin. Asst.

PUBLICATIONS

J.R. Tischler, M.S. Bradley, and V. Bulovic, "Critically coupled resonators in vertical geometry using a planar mirror and a 5nm thick absorbing film," *Optics Letters*, to be published.

P.O. Anikeeva, C.F. Madigan, S.A. Coe-Sullivan, J.S. Steckel, M.G. Bawendi, and V. Bulovic, "Photoluminescence of CdSe/ZnS core/shell quantum dots enhanced by energy transfer from a phosphorescent donor," *Chemical Physics Letters*, Apr. 2006, to be published.

C.F. Madigan and V. Bulovic, "Modeling of exciton diffusion in amorphous organic thin films," *Physical Review Letters*, vol. 96, pp. 046404:1-4, Feb. 2006.

A. Wang, I. Kymissis, V. Bulovic, and A.I. Akinwande, "Engineering density of semiconductor-dielectric interface states to modulate threshold voltage in OFETs," *IEEE Transactions on Electron Devices*, vol. 53, no. 1, pp. 9-13, Jan. 2006.

D.J. Mascaró, M.E. Thompson, H.I. Smith, and V. Bulovic, "Forming oriented organic crystals from amorphous thin films on patterned substrates via solvent-vapor annealing," *Organic Electronics*, vol. 6, no. 5-6, pp. 211-220, Dec. 2005.

K. Ryu, I. Kymissis, V. Bulovic, and C.G. Sodini, "Direct extraction of mobility in pentacene OFETs using C-V and I-V measurements," *IEEE Electron Device Letters*, vol. 26, no. 10, pp. 716-718, Oct. 2005.

D.C. Oertel, M.G. Bawendi, A.C. Arango, and V. Bulovic, "Photodetectors based on treated CdSe quantum-dot films," *Applied Physics Letters*, vol. 87, pp. 213505: 1-3, Nov. 2005.

I. Kymissis, A.I. Akinwande, and V. Bulovic, "A lithographic process flow for integrated organic field-effect transistors," *IEEE Journal of Display Technology*, vol. 1, no. 2, pp. 289-294, Dec. 2005.

M.S. Bradley, J.R. Tischler, and V. Bulovic, "Layer-by-layer J-aggregate thin films with peak absorption constant of 10^6 cm^{-1} ," *Advanced Materials*, vol. 17, no. 15, pp. 1881-1886, July 2005.

J.R. Tischler, M.S. Bradley, V. Bulovic, J.H. Song, and A. Nurmikko, "Strong coupling in a microcavity LED," *Physical Review Letters*, vol. 95, pp. 036401: 1-4, July 2005.

C.A. Breen, J.R. Tischler, V. Bulovic, and T.M. Swager, "Highly efficient blue electroluminescence from poly(phenylene-ethynylene) via energy transfer from a hole transport matrix," *Advanced Materials*, vol. 17, no. 16, pp. 1981-1985, June 2005.

C.A. Breen, S. Rifai, V. Bulovic, and T.M. Swager, "Blue electroluminescence from oxadiazole grafted poly(phenylene-ethynylene)s," *Nano Letters*, vol. 5, no. 8, pp. 1597-1601, June 2005.

J. Chen, V. Leblanc, S.H. Kang, M.A. Baldo, P.J. Benning, M.A. Schmidt, and V. Bulovic, "Direct patterning of organic materials and metals using a micromachined printhead," in *Proc. of the Materials Research Society Meeting*, San Francisco, CA, Apr. 2005, pp. H1.8:1-7.

S.A. Coe-Sullivan, J.S. Steckel, W.-K. Woo, M.G. Bawendi, and V. Bulovic, "Large-area ordered quantum-dot monolayers via phase separation during spin-casting," *Advanced Functional Materials*, vol. 15, no. 7, pp. 1117-1124, Apr. 2005.

A. Rose, Z. Zhu, C.F. Madigan, T.M. Swager, and V. Bulovic, "Sensitivity gains in chemosensing by lasing action in organic polymers," *Nature*, vol. 434, pp. 876-879, Apr. 2005.

Anantha P. Chandrakasan

Joseph F. & Nancy P. Keithley Professor of Electrical Engineering
Department of Electrical Engineering and Computer Science

GRADUATE STUDENTS

M. Bhardwaj, Res. Asst., EECS
R. Blazquez, Res. Asst., EECS
V. Chandrasekar, Res. Asst., EECS
(co-supervised with Prof. D. Troxel)
F. Chen, Res. Asst., EECS (co-supervised with Prof. V. Stojanovic)
T. S. Cho, Res. Asst., EECS
D. Daly, Res. Asst., EECS
N. Dreger, Res. Asst., EECS (co-supervised with Prof. D. Boning)
D. Finchelstein, Res. Asst., EECS
B. Ginsburg, NDSEG Fellowship, EECS
F. Honore, Res. Asst., EECS
N. Ickes, Res. Asst., EECS
A. Kern, Res. Asst., EECS
J. Kwong, Res. Asst., EECS
P. Lajevardi, Res. Asst., EECS
F. Lee, Res. Asst., EECS
T. Pan, Res. Asst., EECS
Y. Ramadass, Res. Asst., EECS
V. Sze, Res. Asst., EECS
N. Verma, Res. Asst., EECS
D. Wentzloff, Res. Asst., EECS

UNDERGRADUATE STUDENTS

M. Scharfstein
Y. Wu

VISITORS

J-S. Kim, Samsung
A. Oishi, Toshiba

SUPPORT STAFF

M. Flaherty, Admin. Asst. II

PUBLICATIONS

B.H. Calhoun and A.P. Chandrakasan, "A 256kb sub-threshold SRAM in 65nm CMOS," *IEEE International Solid-State Circuits Conference*, pp. 628-629, Feb. 2006.

N. Verma and A.P. Chandrakasan, "A 25 μ W 100ks/s 12b ADC for wireless micro-sensor applications," *IEEE International Solid-State Circuits Conference*, pp. 222-223, Feb. 2006.

R. Blazquez, P.P. Newaskar, F.S. Lee, and A.P. Chandrakasan, "A baseband processor for impulse ultra-wideband communications," *IEEE Journal of Solid-State Circuits*, pp. 1821-1828, Sept. 2005.

B.H. Calhoun, A. Wang, and A.P. Chandrakasan, "Modeling and sizing for minimum energy operation in sub-threshold circuits," *IEEE Journal of Solid-State Circuits*, pp. 1778-1786, Sept. 2005.

B.P. Ginsburg and A.P. Chandrakasan, "Dual scalable 500MS/s, 5b time-interleaved SAR ADCs for UWB applications," in *Proc. IEEE 2005 Custom Integrated Circuits Conference*, San Jose, CA, Sept. 2005, pp. 403-406.

N. Checka, A.P. Chandrakasan and R. Reif, "Substrate noise analysis and experimental verification for the efficient noise prediction of a digital PLL," in *Proc. IEEE 2005 Custom Integrated Circuits Conference*, San Jose, CA, Sept. 2005, pp. 473-476.

F.S. Lee and A.P. Chandrakasan, "A BiCMOS ultra-wideband 3.1-10.6GHz front-end," in *Proc. IEEE 2005 Custom Integrated Circuits Conference*, San Jose, CA, Sept. 2005, pp. 153-156.

B.H. Calhoun and A.P. Chandrakasan, "Analyzing static noise margin for subthreshold SRAM in 65nm CMOS," in *Proc. 31st European Solid-State Circuits Conference*, Grenoble, France, Sept. 2005, pp. 363-366.

D.D. Wentzloff, R. Blazquez, F.S. Lee, B.P. Ginsburg, J. Powell, and A.P. Chandrakasan, "System design considerations for ultra-wideband communication," *IEEE Communications Magazine*, vol. 43, no. 8, pp. 114-121, Aug. 2005.

B.H. Calhoun, D.C. Daly, N. Verma, D. Finchelstein, D.D. Wentzloff, A. Wang, S.-H. Cho, and A.P. Chandrakasan, "Design considerations for ultra-low energy wireless microsensor nodes," *IEEE Transactions on Computers*, vol. 54, no. 6, pp. 727-749, June 2005.

D.D. Wentzloff and A.P. Chandrakasan, "A 3.1-10.6 GHz ultra-wideband pulse-shaping mixer," *IEEE Radio Frequency Integrated Circuits Symposium Digest of Papers*, June 2005, pp. 83-86.

N. Checka, D.D. Wentzloff, A.P. Chandrakasan, and R. Reif, "The effect of substrate noise on VCO performance," *IEEE Radio Frequency Integrated Circuits Symposium Digest of Papers*, June 2005, pp. 523-526.

B.P. Ginsburg and A.P. Chandrakasan, "An energy-efficient charge recycling approach for a SAR converter with capacitive DAC," *IEEE International Symposium on Circuits and Systems*, May 2005, pp. 184-187.

Y.-S. Kwon, P. Lajevardi, A.P. Chandrakasan, F. Honore, and D.E. Troxel, "A 3-D FPGA wire resource prediction model validated using a 3-D placement and routing tool," in *Proc. Seventh International Workshop on System-Level Interconnect Prediction*, San Francisco, CA, Apr. 2005, pp. 65-72.

B. Bougard, F. Catthoor, D.C. Daly, A.P. Chandrakasan, and W. Dehaene, "Energy efficiency of the IEEE 802.15.4 standard in dense wireless microsensor networks: Modeling and improvement perspectives," in *Proc. Design, Automation and Test in Europe*, Munich, Germany, Mar. 2005, pp. 196-201.

Gang Chen

Professor

Department of Mechanical Engineering

COLLABORATORS

M.S. Dresselhaus, MIT
J.D. Joannopoulos, MIT
J.-P. Fleurial, JPL
J. B. Freund, UIUC
Z.F. Ren, Boston College
X. Zhang, UC Berkeley

GRADUATE STUDENTS & RESEARCHERS

V. Berube, Res. Asst., Physics
Z. Chen, Res. Asst., ME
X.Y. Chen, Res. Assoc, ME
C. Dames, Res. Asst., ME
J. Garg, Res. Asst., ME
Q. Hao, Res. Asst., ME
T. Harris, Res. Asst., ME
A. Henry, Res. Asst., ME
H. Lee, Res. Asst., ME
H. Lu, Res. Asst., ME
J. Ma, Res. Asst., ME
A. Muto, Res. Asst., ME
S. Nakamura, Visitor, Denso, Japan
A. Narayanaswamy, Res. Asst., ME
G. Radtke, Res. Asst., ME
A. Schmidt, Res. Asst., ME
S. Shen, Res. Asst., ME

SUPPORT STAFF

B. Hilleman, Admin. Asst.

PUBLICATIONS

C. Dames and G. Chen, "1, 2, and 3ω methods for measurement of thermal properties," *Review of Scientific Instruments*, vol. 76, pp. 124902: 1-14, Dec. 2005.

A. Jacquot, G. Chen, H. Scherrer, A. Dauscher, and B. Lenoir, "Improvements of on-membrane method for thin film thermal conductivity and emissivity measurements," *Sensors and Actuators A*, vol. 117, no. 2, pp. 203-210, Jan. 2005.

R.G. Yang, G. Chen, M. Laroche, and Y. Taur, "Simulation of nanoscale multidimensional transient heat conduction problems using ballistic-diffusive equations and phonon boltzmann equation," *Journal of Heat Transfer*, vol. 127, no. 3, pp. 298-306, Mar. 2005.

R.G. Yang, G. Chen, A. R. Kumar, G. J. Snyder, and J.-P. Fleurial, "Transient response of thermoelectric coolers and its applications for microdevices," *Energy Conversion and Management*, vol. 46, no. 9-10, pp. 1407-1421, June 2005.

R.G. Yang, A. Narayanaswamy, and G. Chen, "Surface-Plasmon coupled nonequilibrium thermoelectric refrigerators and power generators," *Journal of Theoretical and Computational Nanoscience*, vol. 2, no. 1, pp. 75-87, Mar. 2005.

G. Chen, R. Yang, and X. Chen, "Nanoscale heat transfer and thermal-electric energy conversion," *Journal de Physique IV*, vol. 125, pp. 499-504, June 2005.

D.A. Borca-Tasciuc and G. Chen, "Thermal properties of nanochanneled alumina templates," *Journal of Applied Physics*, vol. 97, pp. 084303: 1-9, Apr. 2005.

G. Chen, "Potential step amplified thermal-electric energy converters," *Journal of Applied Physics*, vol. 97, pp. 083707: 1-8, Apr. 2005.

D.K. Qing and G. Chen, "Nanoscale optical waveguides with negative dielectric claddings," *Physical Review B*, vol. 71, pp. 153107: 1-4, Apr. 2005.

R.G. Yang, G. Chen, and M.S. Dresselhaus, "Thermal conductivity modeling of core-shell and tubular nanowires," *Nano Letter*, vol. 5, no. 6, pp. 1111-1115, 2005.

J.Y. Huang, S. Chen, S. H. Jo, Z. Wang, G. Chen, M.S. Dresselhaus, and Z.F. Ren, "Atomic-scale imaging of wall-by-wall breakdown and concurrent transport measurements in multiwall carbon nanotubes," *Physical Review Letters*, vol. 94, pp. 236802: 1-4, June, 2005.

C. Dames, G. Chen, B. Poudel, W. Wang, J. Huang, Z. Ren, Y. Sun, J.I. Oh, C. Opeil, and M.J. Naughton, "Low-dimensional phonon specific heat of titanium dioxide nanotubes," *Applied Physics Letters*, vol. 87, pp. 031901: 1-3, July 2005.

G. Chen and R.G. Yang, "Nanostructured thermoelectric materials: From superlattices to nanocomposites," *Materials Integration*, vol. 18, special issue, Sept. 2005.

A. Jacquot, G. Chen, H. Scherrer, A. Dauscher, and B. Lenoir, "Improvements of on-membrane method for thin film thermal conductivity and emissivity measurements," *Sensors and Actuators A*, vol. 117, no. 2, pp. 203-210, Jan. 2005.

R.G. Yang, G. Chen, A.R. Kumar, G. J. Snyder, and J.-P. Fleurial, "Transient response of thermoelectric coolers and its applications for microdevices," *Energy Conversion and Management*, vol. 46, no. 9-10, pp. 1407-1421, June 2005.

R.G. Yang, G. Chen, M. Laroche, and Y. Taur, "Simulation of nanoscale multidimensional transient heat conduction problems using ballistic-diffusive equations and phonon Boltzmann equation," *Journal of Heat Transfer*, vol. 127, no. 3, pp. 298-306, Mar. 2005.

Michael J. Cima

Sumitomo Electric Industries Professor of Engineering
Department of Materials Science and Engineering

COLLABORATORS

J. Anderson, Prof., Case Western Reserve University
H. Brem, Prof., Johns Hopkins U. School of Med.
L. Josephson, Assoc. Prof., Harvard Med. School
R.S. Langer, MIT
M. Seiden, Assoc. Prof., Harvard Med. School
R. Weissleder, Prof., Harvard Med. School

GRADUATE STUDENTS

J. Bullard, Res. Assistant, MSE
K. Daniel, Res. Assistant, ChemE
H.L. Ho Duc, Res. Assistant, MSE
G.Y. Kim, NSF Fellowship, HST
H. Lee, Samsung Fellowship, ME
Y. Patta, Res. Assistant, MSE
C. Vassiliou, Res. Assistant, EECS
D. Wesolowski, Res. Assistant, MSE
M. Yoshizumi, Res. Associate, MSE

SUPPORT STAFF

B. Layne, Admin. Asst.
L. Rigione, Project Technician
J. Centorino, Project Technician

PUBLICATIONS

D.E. Wesolowski and M.J. Cima, "Nitrate-based metalorganic deposition of CeO_2 on yttrium-stabilized zirconia", *Journal of Materials Research*, vol. 21, no. 1, pp. 1-4, Jan. 2006.

Y.W. Li, H.L. Ho Duc, B. Tyler, T. Williams, M. Tupper, R.S. Langer, H. Brem, and M.J. Cima, "In vivo delivery of BCNU from a MEMS device to a tumor model," *Journal of Controlled Release*, vol. 106, no. 1-2, pp. 138-145, Aug. 2005.

M. Yoshizumi, D.E. Wesolowski, and M.J. Cima, "Determination of HF partial pressure during *ex situ* conversion of YBCO precursors," *Physica C: Superconductivity and Its Applications*, vol. 423, no. 3-5, pp. 75-82, July 2005.

A.C.R. Grayson, M.J. Cima, and R.S. Langer, "Size and temperature effects on poly(lactic-co-glycolic acid) degradation and microreservoir device performance," *Biomaterials*, vol. 26, no. 14, pp. 2137-2145, May 2005.

H.R. Wang, M.J. Cima, B.D. Kernan, and E.M. Sachs, "Alumina-doped silica gradient-index (GRIN) lenses by slurry-based three-dimensional printing (S-3DP)," *Journal of Non-Crystalline Solids*, vol. 349, pp. 360-367, Dec. 2004.

A.M. Johnson, D.R. Sadoway, M.J. Cima, and R.S. Langer, "Design and testing of an impedance-based sensor for monitoring drug delivery," *Journal of the Electrochemical Society*, vol. 152, no. 1, pp. H6-H11, Nov. 2004.

Y. Li, R.S. Shawgo, B. Tyler, P.T. Henderson, J.S. Vogel, A. Rosenberg, P.B. Storm, R.S. Langer, H. Brem, and M.J. Cima, "In vivo release from a drug delivery MEMS device," *Journal of Controlled Release*, vol. 100, no. 2, pp. 211-219, Nov. 2004.

A.C.R. Grayson, I.S. Choi, B.M. Tyler, P.P. Wang, H. Brem, M.J. Cima, and R.S. Langer, "Multi-pulse drug delivery from a resorbable polymeric microchip device," *Nature Materials*, vol. 2, no. 11, pp. 767-772, Nov. 2003.

R.K. Holman, M.J. Cima, S.A. Uhland, and E.M. Sachs, "Spreading and infiltration of inkjet-printed polymer solution droplets on a porous substrate," *Journal of Colloid and Interface Science*, vol. 249, no. 2, pp. 432-440, May 2002.

S.A. Uhland, R.K. Holman, S. Morissette, M.J. Cima, M.J., and E.M. Sachs, "Strength of green ceramics with low binder content," *Journal of the American Ceramic Society*, vol. 84, no. 12, pp. 2809-2818, Dec. 2001.

Martin L. Culpepper

Rockwell International Associate Professor
Department of Mechanical Engineering

COLLABORATORS

S.G. Kim, MIT
P. So, MIT
M. Schattenburgh, MIT
J. Vance, ISU
L. Howell, BYU
S. Magleby, BYU
J. Ziegert, UFL

GRADUATE STUDENTS

D. Golda, Res. Asst., ME
S. Chen, Res. Asst., ME
K. Lin, Res. Asst., ME

SUPPORT STAFF

M. Sullivan, Adm. Asst.

PUBLICATIONS

- S.C. Chen and M.L. Culpepper, "Design of a six-axis micro-scale nanopositioner – μ HexFlex," *Precision Engineering*, vol. 30, no. 3, pp. 314-324, July 2006.
- N.B. Hubbard, M.L. Culpepper, and L.L. Howell, "Actuators for micropositioners and nanopositioners," *Applied Mechanics Reviews*, to be published.
- S.C. Chen and M.L. Culpepper, "Design of contoured micro-scale thermomechanical actuators," *IEEE/ASME Journal of Microelectromechanical Systems*, to be published.
- K.V. Mangudi and M.L. Culpepper, "A hybrid positioner-fixture for precision six-axis positioning and precision fixturing – Part I: Modeling and design," *Precision Engineering*, to be published.
- K.V. Mangudi and M.L. Culpepper, "A hybrid positioner-fixture for precision six-axis positioning and precision fixturing – Part II: Characterization and calibration," *Precision Engineering*, to be published.
- S.C. Chen, M.L. Culpepper, S. Jordan, J. Danieli, and J. Wenger, "Application of input shaping and hyperbit control to improve the dynamic performance of a six-axis micro-scale nanopositioner," *Journal of Microelectromechanical Systems*, to be published.
- D. Golda, and M.L. Culpepper, "Modeling, simulation and experimental verification of three dimensional fields due to non-periodic permanent magnet arrays with vertical magnetization," *IEEE Transactions on Magnetics*, to be published.
- M.L. Culpepper, C.M. Dibiasio, S. Magleby, and L. Howell, "Modeling and simulation of a compliant parallel guiding mechanism for nanomechanical devices," *Physical Review Letters*, to be published.
- M.L. Culpepper, C.M. Dibiasio, S. Magleby, and L. Howell, "Modeling and simulation of a compliant parallel guiding mechanism for nanomechanical devices," *Physical Review Letters*, to be published.
- M.L. Culpepper, C.M. Dibiasio, S. Magleby, and L. Howell "Modeling of a carbon nanotube-based compliant parallel-guiding mechanism – a comparison of molecular mechanics simulations and pseudo rigid body model," *Journal of Mechanical Design*, to be published.
- K.M. Varadajan, and M.L. Culpepper, "Design of a miniature hybrid positioner-fixture for six-axis scanning and detachable fixturing in nano-instrumentation," to be presented at the *2006 Annual Meeting of the American Society for Precision Engineering*, Monterrey, CA, Oct. 2006.
- S.C. Chen, J. Choi, D. Kim, M.L. Culpepper, and P. So, "Design of a high-speed, micro-scale fast scanning stage for two-photon endomicroscopy," to be presented at the *2006 Annual Meeting of the American Society for Precision Engineering*, Monterrey, CA, Oct. 2006.
- S.C. Chen, M.L. Culpepper, and S. Jordan, "Application of input shaping and hyperbit control to improve the dynamic performance of a six-axis MEMS nanopositioner," to be presented at the *2006 Annual Meeting of the American Society for Precision Engineering*, Monterrey, CA, Oct. 2006.
- S.C. Chen, J. Bardt, J. Ziegert, and M.L. Culpepper, "Formation of micro-scale precision flexures via molding of metallic glass," to be presented at the *2006 Annual Meeting of the American Society for Precision Engineering*, Monterrey, CA, Oct. 2006.
- D. Golda and M.L. Culpepper, "A scalable six-axis electromagnetically-driven nanopositioner for nanomanufacturing," to be presented at the *2006 Annual Meeting of the American Society for Precision Engineering*, Monterrey, CA, Oct. 2006.
- S.C. Chen and M.L. Culpepper, "Design and optimization of thermomechanical actuators via contour shaping," presented at *2005 ASME International Mechanical Engineering Congress and Exposition*, 2005.

Luca Daniel

Assistant Professor

Department of Electrical Engineering and Computer Science

COLLABORATORS

A. Megretski, MIT

J. White, MIT

GRADUATE STUDENTS

B. Bond, Res. Asst., EECS

T.A. El Moselhy, Res. Asst., EECS

X. Hu, Res. Asst., EECS

K.C. Sou, Res. Asst., EECS

SUPPORT STAFF

C. Collins, Admin. Asst.

PUBLICATIONS

B. Bond and L. Daniel, "Parameterized model order reduction of nonlinear dynamical systems," in *Proc. IEEE International Conference on Computer-Aided Design*, San Jose, CA, Nov. 2005, pp. 487-494.

L. Daniel, "Krylov subspace moment matching parameterized model order reduction of large circuit structures," presented at *SIAM Conference on Control and its Applications*, 2005.

K. Sou, A. Megretski, and L. Daniel, "A quasi-convex optimization approach to parameterized model order reduction," in *Proc. 42nd Design Automation Conference*, Anaheim, CA, June 2005, pp. 933-938.

X. Hu, J. Lee, L. Daniel, and J. White, "Analysis of full-wave conductor system impedance over substrate using novel integration techniques," in *Proc. 42nd Design Automation Conference*, Anaheim, CA, June 2005, pp. 147-152.

T. Klemas, L. Daniel, and J. White, "Segregation by primary phase factors: a full-wave algorithm for model-order reduction," in *Proc. 42nd Design Automation Conference*, Anaheim, CA, June 2005, pp. 943-946.

T. Klemas, L. Daniel, and J. White, "A fast full-wave algorithm to generate low order electromagnetic scattering models," *Antennas and Propagation Society International Symposium*, June 2005, pp. 135-138.

J. Lee, V. Dmitry, A. Vithayathil, L. Daniel, and J. White, "Accelerated optical topography using parameterized model order reduction," *International Microwave Symposium Digest*, June 2005, pp. 1171-1174.

A. Devgan, L. Daniel, B. Krauter, and L. He, "Modeling and design of chip-package interface," *Sixth International Symposium on Quality Electronic Design*, Mar. 2005.

S. Elassaad, Z. Zhu, and L. Daniel, "Chip-package co-design: Signal and power integrity issues, parasitic extraction, parameterized model order reduction," presented at *10th Asia Pacific Design Automation Conference*, 2005.

Joel L. Dawson

Carl Richard Soderberg Career Development Professor of Power Engineering
Department of Electrical Engineering and Computer Science

GRADUATE STUDENTS

S. Chung, Res. Asst., EECS
A. Hadiashar, Res. Asst., EECS
J. Holloway, Res. Asst., EECS
J. Huang, Res. Asst., EECS
T. Khanna, Res. Asst., EECS
S. Rayanakorn, Res. Asst., EECS
W. Sanchez, Res. Asst., EECS

SUPPORT STAFF

R. Maynard, Admin. Asst. II

PUBLICATIONS

J.L. Dawson and T.H. Lee, "Cartesian feedback for RF power amplifier linearization," in *Proc. American Control Conference*, Boston, MA, Jul. 2004, pp. 361-366.

J.L. Dawson and T.H. Lee, "Automatic phase alignment for a fully integrated cartesian feedback power amplifier system," *IEEE Journal of Solid-State Circuits*, vol. 38, no. 12, pp. 2269-2279, Dec. 2003.

J.L. Dawson and T.H. Lee, "Automatic phase alignment for a fully integrated CMOS cartesian feedback power amplifier system," in *IEEE International Solid-State Circuits Conference Digest of Technical Papers*, San Francisco, CA, Feb. 2003, pp. 262-263.

J.L. Dawson, S.P. Boyd, M. Hershenson, and T.H. Lee, "Optimal allocation of local feedback in multistage amplifiers via geometric programming," *IEEE Transactions on Circuits and Systems I*, vol. 48, no. 1, pp. 1-11, Jan. 2001.

J.L. Dawson and T.H. Lee, "Automatic phase alignment for high bandwidth cartesian feedback power amplifiers," in *Proc. IEEE Radio and Wireless Conference*, Denver, CO, Sept. 2000, pp. 71-74.

J.L. Dawson, S.P. Boyd, M. Hershenson, and T.H. Lee, "Optimal allocation of local feedback in multistage amplifiers via geometric programming," in *Proc. 43rd Midwest Symposium on Circuits and Systems*, Lansing, MI, Aug. 2000, pp. 530-533.

Jesús del Alamo

Professor

Department of Electrical Engineering and Computer Science

COLLABORATORS

B. R. Bennett, NRL
T. Enoki, NTT
D. Greenberg, IBM
K. Hayashi, Mitsubishi Electric
T. Hisaka, Mitsubishi Electric
A. Inoue, Mitsubishi Electric
T. Suemitsu, NTT

RESEARCH STAFF

J. Hardison
D. Zych

POSTDOCTORAL FELLOW

D.H. Kim

GRADUATE STUDENTS

B. Cukalovic, Teaching Assistant, EECS
S. Gikandi, Teaching Assistant, EECS
A. Haldar, Teaching Assistant, EECS
J. Joh, Res. Asst., EECS
J. Scholvin, Res. Asst., EECS
A. Villanueva, Res. Asst., EECS
N. Waldron, Res. Asst., EECS
M. Wong, Res. Asst., EECS
J. Wu, Res. Asst., EECS

SUPPORT STAFF

E. Kubicki, Admin. Asst. II

PUBLICATIONS

R.J. Blanchard and J.A. del Alamo, "Stress-related hydrogen degradation of 0.1 μ m InP HEMTs and GaAs PHEMTs," *IEEE Transactions on Electron Devices*, to be published.

J. Scholvin, J.G. Fiorenza, and J.A. del Alamo, "The impact of substrate surface potential on the performance of RF power LD MOSFETs on high-resistivity SOI," *IEEE Transactions on Electron Devices*, to be published.

A. Inoue, H. Amasuga, S. Goto, T. Kunii, M.F. Wong, and J.A. del Alamo, "A non-linear drain resistance model for a high power millimeter-wave PHEMT," to be presented at *IEEE MTT-S International Microwave Symposium (IMS)*, San Francisco, CA, June 2006.

D.-H. Kim, J.A. del Alamo, J.H. Lee, and K.S. Seo, "The impact of side-recess spacing on the logic performance of 50 nm In_{0.7}Ga_{0.3}As HEMTs," presented at the *18th Conference on Indium Phosphide & Related Materials*, 2006.

D.-H. Kim and J.A. del Alamo, "Beyond CMOS: logic suitability of In_{0.7}Ga_{0.3}As HEMT," in *Proc. 2006 International Conference on Compound Semiconductor Manufacturing Technology (CS MANTECH)*, Vancouver, Canada, Apr. 2006, pp. 251-254.

J. Scholvin, D.R. Greenberg, and J.A. del Alamo, "Performance and limitations of 65 nm CMOS for integrated RF power applications," in *IEEE International Electron Devices Meeting Technical Digest*, Washington, DC, Dec. 2005, pp. 381-384.

D.-H. Kim, J.A. del Alamo, J.H. Lee, and K.S. Seo, "Performance evaluation of 50 nm In_{0.7}Ga_{0.3}As HEMTs for beyond-CMOS logic applications," in *IEEE International Electron Devices Meeting Technical Digest*, Washington, DC, Dec. 2005, pp. 787-790.

A.S. Villanueva, J.A. del Alamo, T. Hisaka, K. Hayashi, and M. Somerville, "Non-uniform degradation behavior across device width in RF power GaAs PHEMTs," in *IEEE International Electron Devices Meeting Technical Digest*, Washington, DC, Dec. 2005, pp. 803-806.

M.F. Wong, J.A. del Alamo, A. Inoue, T. Hisaka and K. Hayashi, "Impact of drain recess length on the RF power performance of GaAs PHEMTs," presented at *6th Topical Workshop on Heterostructure Microelectronics*, 2005.

N.S. Waldron, A.J. Pitera, M.L. Lee, E.A. Fitzgerald, and J.A. del Alamo, "Positive temperature coefficient of impact ionization in strained-Si/SiGe heterostructures," *IEEE Transactions on Electron Devices*, vol. 52, no. 7, pp. 1627-1633, July 2005.

Eugene A. Fitzgerald

Professor

Department of Materials Science & Engineering

COLLABORATORS

S. Ringel, Ohio State University
S.F. Yoon, Nanyang Technology University, Singapore
W.K. Choi, National University of Singapore
S.J. Chua, National University of Singapore
K.L. Pey, Nanyang Technology University, Singapore
W.K. Chim, National University of Singapore

GRADUATE STUDENTS

M. Lee, Postdoctoral Associate, DMSE
N. Quitariano, Res. Asst., DMSE
D. Isaacson, Res. Asst., DMSE
M. Mori, Res. Asst., DMSE
C. Dohrman, Res. Asst., DMSE
S. Gupta, Res. Asst., DMSE
K. Chilukuri, Res. Asst., DMSE
K. Lee, Res. Asst., EE and DMSE
Y. Bai, Res. Asst., DMSE

SUPPORT STAFF

A. Afonso, Admin. Asst. II

PUBLICATIONS

E.A. Fitzgerald, "Engineered substrates and their future role in microelectronics," *Materials Science and Engineering B*, vols. 124-125, pp. 8-15, Dec. 2005.

E.A. Fitzgerald, M.L. Lee, B. Yu, K.E. Lee, C.L. Dohrman, D. Isaacson, T.A. Langdo, and D.A. Antoniadis, "Dislocation engineering in strained MOS materials," in *IEEE International Electron Devices Meeting Technical Digest*, Washington, DC, Dec. 2005, pp. 513-516.

M.A. Rahman, T. Osipowics, K.L. Pey, L.J. Jin, W.K. Choi, D.Z. Chi, D.A. Antoniadis, E.A. Fitzgerald and D.M. Isaacson, "Suppression of oxidation in nickel germanosilicides by Pt incorporation," *Applied Physics Letters*, vol. 87, pp. 182116:1-3, Oct. 2005.

H.Q. Le, S.J. Chua, Y.W. Koh, K.P. Loh, Z. Chen, C.V. Thompson, and E.A. Fitzgerald, "Growth of single crystal ZnO nanorods on GaN using an aqueous solution method," *Applied Physics Letters*, vol. 87, pp.101908:1-3, Sept. 2005.

L.J. Jin, K.L. Pey, W.K. Choi, E.A. Fitzgerald, D.A. Antoniadis, A.J. Pitera, M.L. Lee, D.Z. Chi, M.A. Rahman, T. Osipowics, and C.H. Tung, "Effect of Pt on agglomeration and Ge out diffusion in Ni(Pt) germanosilicide," *Journal of Applied Physics*, vol. 98, pp. 33520:1-6, Aug. 2005.

N. Ariel, G. Ceder, D. Sadoway, and E.A. Fitzgerald, "Electrochemically controlled transport of lithium through ultrathin SiO₂," *Journal of Applied Physics*, vol. 98, pp. 023516:1-7, July 2005.

C.L. Andre, D.M. Wilt, A.J. Pitera, M.L. Lee, E.A. Fitzgerald and S.A. Ringel, "Impact of dislocation densities on n⁺/p and p⁺/n junction GaAs diodes and solar cells on SiGe virtual substrates," *Journal of Applied Physics*, vol. 98, pp.14502:1-5, July 2005.

A.P. Vajpeyi, S. Tripathy, S.J. Chua, and E.A. Fitzgerald, "Investigation of optical properties of nanoporous GaN films," *Physica E*, vol. 28, no. 2, pp. 141-149, July 2005.

N.S. Waldron, A.J. Pitera, M.L. Lee, E.A. Fitzgerald and J.A. del Alamo, "Positive temperature coefficient of impact ionization in strained-Si," *IEEE Transactions on Electron Devices*, vol. 52, no. 7, pp.1627-33, July 2005.

C.L. Andre, J.A. Carlin, J.J. Boeckl, D.M. Wilt, M.A. Smith, A.J. Pitera, M.L. Lee, E.A. Fitzgerald, and S.A. Ringel, "Investigations of high performance GaAs solar cells grown on Ge-SiGe-Si substrates," *IEEE Transactions on Electron Devices*, vol. 52, no. 6, pp. 1055-1060, June 2005.

C.L. Andre, J.A. Carlin, J.J. Boeckl, D.M. Wilt, M.A. Smith, A.J. Pitera, M.L. Lee, E.A. Fitzgerald, and S.A. Ringel, "Investigations of high-performance GaAs solar cells grown on Ge-Si_{1-x}Ge_x-Si substrates," *IEEE Transactions on Electron Devices*, vol. 52, no. 6, pp.1055-60, June 2005.

S. Gupta, M.L. Lee, and E.A. Fitzgerald, "Improved hole mobilities and thermal stability in a strained-Si/strained-Si_{1-y}Ge_y/strained-Si heterostructure grown on a relaxed Si_{1-x}Ge_x buffer," *Applied Physics Letters*, vol. 86, pp. 192104:1-3, May 2005.

A.J. Pitera and E.A. Fitzgerald, "Hydrogen gettering and strain-induced platelet nucleation in tensilely strained Si_{0.4}Ge_{0.6}/Ge for layer exfoliation applications," *Journal of Applied Physics*, vol. 97, pp. 104511:1-11, May 2005.

L.J. Jin, K.L. Pey, W.K. Choi, E.A. Fitzgerald, A.J. Pitera, M.L. Lee, and C.H. Tung, "Highly oriented Ni(Pd)SiGe formation at 400 degrees C," *Journal of Applied Physics*, vol. 97, pp. 104917:1-5, May 2005.

Clifton G. Fonstad, Jr.

Professor

Department of Electrical Engineering and Computer Science

COLLABORATORS

Y.S. Fatt, Nanyang Technological

University, Singapore

F.J. Cadieu, Queens College of CUNY

C.S. Jin, National University of
Singapore

S. Prasad, Northeastern U.

D. Brooks, Northeastern U.

GRADUATE STUDENTS

E. Barkley, Res. Asst., EECS

S. Faminini, Res. Asst., EECS

J. Perkins, Res. Asst., EECS

J. Rumpler, Res. Asst., EECS

SUPPORT STAFF

A. Glass, Admin. Asst. II

PUBLICATIONS

H.K.H. Choy and C.G. Fonstad, Jr.,
“Enhanced room temperature PL from
metamorphic InGaAs/ InGaAlAs
quantum wells on InGaAs graded
buffers after thermal annealing,”
submitted for publication.

H.K.H. Choy and C.G. Fonstad, Jr.,
“Strain induced photoluminescence
degradation of InGaAs/ InGaAlAs
quantum wells grown metamorphically
on InGaAs graded buffers,” submitted
for publication.

Y.D. Wang, K.Y. Zang, S.J. Chua, and
C.G. Fonstad, Jr., “Microstructures
and optical properties of ordered
InGaN nanodot arrays,” submitted for
publication.

Y.D. Wang, K.Y. Zang, S.J. Chua,
P. Chen, M.S. Sander, S. Tripathy,
and C.G. Fonstad, Jr., “High density
arrays of InGaN nanorings, nanodots,
and nanopillars fabricated by a
template-assisted approach,” submitted
for publication.

Y.D. Wang, K.Y. Zang, S.J. Chua, P.
Chen, H.L. Zhou, S. Tripathy, and
C.G. Fonstad, Jr., “Improvement of
microstructural and optical properties
of GaN layer on sapphire by nano-
scale lateral epitaxial overgrowth,”
submitted for publication.

J.J. Rumpler and C.G. Fonstad, Jr.,
“The Micro-cleaving of precisely
dimensioned semiconductor lasers,”
submitted for publication.

J.J. Rumpler, E. Barkley, J.A. Perkins,
and C.G. Fonstad, Jr., “Precision
micro-cleaving of 1.55 μm laser diode
platelets for integration with dielectric
waveguides on silicon integrated
circuit wafers,” presented at the *19th
Conference on Indium Phosphide and Related
Materials*, 2006.

Y.D. Wang, K.Y. Zang, S.J. Chua, S.
Tripathy, P. Chen, and C.G. Fonstad, Jr.,
“Nanoair-bridged lateral overgrowth
of GaN on ordered nanoporous GaN
template,” *Applied Physics Letters*, no. 87,
pp. 251915:1-3, Dec. 2005.

H.K.H. Choy and C.G. Fonstad, Jr.,
“Effects of substrate temperature on
the growth of InGaAs compositionally
graded buffers and quantum well
structures grown above them,” *Journal
of Vacuum Science & Technology B*, vol. 23,
no. 5, pp. 2109-2113, Sep/Oct 2005.

P. Chen, S.J. Chua, Y.D. Wang, M.D.
Sander, and C.G. Fonstad, Jr., “InGaN
nanorings and nanodots by selective
area epitaxy,” *Applied Physics Letters*, no.
87, pp. 143111:1-3, Oct. 2005.

H.K.H. Choy and C.G. Fonstad, Jr.,
“Strong room temperature PL from
metamorphic InGaAs QWs: Issues
beyond dislocation density,” presented
at *2005 Electronic Materials Conference*,
2005.

Y.D. Wang, S.J. Chua, S. Tripathy, M.S.
Sander, P. Chen, S. Tripathy, and C.G.
Fonstad, “High quality GaN nanopillar
arrays,” *Applied Physics Letters*, vol. 86,
pp. 071917:1-3, Feb. 2005.

Jongyoon Han

Associate Professor

Department of Electrical Engineering and Computer Science / Biological Engineering

COLLABORATORS

S. Tannenbaum, MIT
S. Manalis, MIT
P. Doyle, MIT
M. Rubner, MIT
Tae-Song Kim, KIST, Korea
N. Hadjiconstantinou, MIT
Y. Chen, NUS, Singapore

GRADUATE STUDENTS

J. Fu, Res. Asst., ME
Y.-C. Wang, Res. Asst., ME
P. Mao, Res. Asst., ME
H. Bow, Res. Asst., EECS
H. Jang, Res. Asst., ME
P. Dextras, Res. Asst., BE
N. ReyesGonzalez, Res. Asst., EECS

RESEARCH STAFF

Y. Song, Ph.D.
J. Lee, Ph.D.
S. Kim, Ph.D.

SUPPORT STAFF

S. Chafe, Admin. Asst.

PUBLICATIONS

Y.-A. Song, S. Hsu, A. Stevens, and J. Han, "Continuous-flow pi-based sorting of proteins and peptides in a microfluidic chip using diffusion potential," *Analytical Chemistry*, submitted for publication.

J. Fu, J. Yoo, and J. Han, "Molecular sieving in periodic free-energy landscapes created by patterned nanofilter arrays," *Physical Review Letters*, submitted for publication.

J. Fu, P. Mao, and J. Han, "A nanofilter array chip for fast gel-free biomolecule separation," *Applied Physics Letters*, vol. 87, pp. 263902:1-3, Dec. 2005.

Y.-C. Wang, C. Tsau, T. Burg, S. Manalis, and J. Han, "Efficient biomolecule pre-concentration by nanofilter triggered electrokinetic trapping," in *Proc. 9th International Conference on Miniaturized Systems for Chemistry and Life Sciences (μ TAS)*, Boston, MA, Oct. 2005, pp. 238-240.

P. Mao and J. Han, "Fabrication and characterization of planar nanofluidic channels and massively-parallel vertical nanofluidic membranes," in *Proc. 9th μ TAS*, Boston, MA, Oct. 2005, pp. 678-680.

Y.-A. Song and J. Han, "Continuous pi-based sorting of proteins and peptides in a microfluidic chip using diffusion potential," in *Proc. 9th μ TAS*, Boston, MA, Oct. 2005, pp. 1025-1027.

J. Fu and J. Han, "A nanofilter array chip for fast gel-free biomolecule separation," in *Proc. 9th μ TAS*, Boston, MA, Oct. 2005, pp. 1531-1533.

P. Mao and J. Han, "Fabrication and characterization of 20 nm nanofluidic channels by glass-glass and glass-silicon bonding," *Lab Chip*, vol. 5, no. 8, pp. 837-844, Aug. 2005.

Y.C. Wang, A.L. Stevens, and J. Han, "Million-fold preconcentration of proteins and peptides by nanofluidic filter," *Analytical Chemistry*, vol. 77, no. 14, pp. 4293-4299, July 2005.

Y.-C. Wang, J. Fu, P. Mao, and J. Han, "Nanofluidic molecular filters for efficient protein separation and preconcentrations," in *13th International Conference on Transducers Digest of Technical Papers*, Seoul, Korea, June 2005, pp. 352-355.

M.H. Choi, Y.-C. Wang, J.S. Wishnok, S.R. Tannenbaum, and J. Han, "On-chip isoelectric focusing coupled to micro liquid chromatography in blood proteomics," in *Proc. 8th μ TAS*, Malmo, Sweden, Sept. 2004, pp. 255-257.

J. Fu and J. Han, "Biomolecule separation in nanofluidic filters by steric hindrance mechanism," in *Proc. 8th μ TAS*, Malmo, Sweden, Sept. 2004, pp. 285-287.

Judy L. Hoyt

Professor

Department of Electrical Engineering and Computer Science

COLLABORATORS

D. Antoniadis, MIT
J. del Alamo, MIT
E. Fitzgerald, MIT
L.C. Kimerling, MIT
B. Scharf, Analog Devices
J. Yasaitis, Analog Devices
C.-L. Chen, Lincoln Labs

GRADUATE STUDENTS

I. Åberg, Res. Asst., EECS
C. Ní Chléirigh, Res. Asst., EECS
N. DiLello, Res. Asst., EECS
L. Gomez, Res. Asst., EECS
P. Hashemi, Res. Asst., EECS
M. Kim, Res. Asst., DMSE
O.O. Olubuyide, Res. Asst., EECS
G. Xia, Res. Asst., EECS

RESEARCH STAFF

R. Lei, Visiting Scientist, Intel
G. Riggott, Research Specialist

SUPPORT STAFF

M. Hudak, Admin. Asst. II

PUBLICATIONS

G. Xia, O.O. Olubuyide, J.L. Hoyt, and M. Canonico, "Strain dependence of Si-Ge interdiffusion in epitaxial Si/Si_{1-y}Ge_y/Si heterostructures on relaxed Si_{1-x}Ge_x substrates," *Applied Physics Letters*, vol. 88, pp. 13507:1-3, Jan. 2006.

R.Z. Lei, W. Tsai, I. Åberg, T.B. O'Reilly, J.L. Hoyt, D.A. Antoniadis, H.I. Smith, A.J. Paul, M.L. Green, J. Li, and R. Hull, "Strain relaxation in patterned strained silicon directly on insulator structures," *Applied Physics Letters*, vol. 87, pp. 251926:1-3, Dec. 2005.

I. Åberg, T.A. Langdo, Z.-Y. Cheng, A. Lochtefeld, I. Lauer, D.A. Antoniadis, and J.L. Hoyt, "Transport and leakage in super-critical thickness strained silicon on insulator MOSFETs with strained Si thickness up to 135 nm," in *Proc. IEEE International SOI Conference*, Honolulu, HI, Oct. 2005, pp. 24-26.

I. Åberg and J.L. Hoyt, "Hole transport in UTB MOSFETs in strained-Si directly on insulator with strained-Si thickness less than 5 nm," *IEEE Electron Device Letters*, vol. 26, no. 9, pp. 661-663, Sept. 2005.

C. Ní Chléirigh, O.O. Olubuyide, and J.L. Hoyt, "Mobility and sub-threshold characteristics in high-mobility dual-channel strained Si/strained SiGe p-MOSFETs," in *63rd Device Research Conference Digest*, Santa Barbara, CA, June 2005, pp. 203-204.

O.O. Olubuyide, D.T. Danielson, L.C. Kimerling, and J.L. Hoyt, "Impact of seed layer on material quality of epitaxial germanium on silicon deposited by low pressure chemical vapor deposition," presented at *4th Intl. Conf. on Silicon Epitaxy and Heterostructures*, 2005.

I. Åberg, C. Ní Chléirigh, and J.L. Hoyt, "Thermal processing and mobility in strained heterostructures on insulator," in *Proc. 207th Meeting of The Electrochemical Society*, Quebec City, Canada, May 2005, pp. 505-514.

I. Åberg, C. Ní Chléirigh, O.O. Olubuyide, X. Duan, and J.L. Hoyt, "High electron and hole mobility enhancements in thin-body strained Si/strained SiGe/strained Si heterostructure on insulator," in *IEEE International Electron Devices Meeting Technical Digest*, San Francisco, CA, Dec. 2004, pp. 173-176.

H.M. Nayfeh, J.L. Hoyt, and D.A. Antoniadis, "A physically based analytical model for the threshold voltage of strained-Si n-MOSFETs," *IEEE Transactions on Electron Devices*, vol. 51, no. 12, pp. 2069-2072, Dec. 2004.

G. Xia, H.M. Nayfeh, M.L. Lee, E.A. Fitzgerald, D.A. Antoniadis, D.H. Anjum, J. Li, R. Hull, N. Klymko, and J.L. Hoyt, "Impact of ion implantation damage and thermal budget on mobility enhancement in strained-Si N-channel MOSFETs," *IEEE Transactions on Electron Devices*, vol. 51, no. 12, pp. 2136-2144, Dec. 2004.

J.L. Hoyt, "Enhanced mobility CMOS," in *Proc. 206th Meeting of The Electrochemical Society*, Honolulu, HI, Oct. 2004, pp. 15-24.

C. Ní Chléirigh, C. Jungemann, J. Jung, O.O. Olubuyide and J.L. Hoyt, "Extraction of band offsets in strained Si/strained SiGe on relaxed SiGe dual-channel enhanced mobility structures," in *Proc. 206th Meeting of The Electrochemical Society*, Honolulu, HI, Oct. 2004, pp. 99-110.

I. Åberg, O.O. Olubuyide, J. Li, R. Hull, and J.L. Hoyt, "Fabrication of strained Si/strained SiGe/strained Si heterostructures on insulator by a bond and etch-back technique," in *Proc. IEEE International SOI Conference*, Arlington, VA, Oct. 2004, pp. 35-36.

J. Jung, S. Yu, M. L. Lee, J.L. Hoyt, E.A. Fitzgerald, and Dimitri A. Antoniadis, "Mobility enhancement in dual-channel p-MOSFETs," *IEEE Transactions on Electron Devices*, vol. 51, no. 9, pp. 1424-1431, Sept. 2004.

J. Jung, C. Ní Chléirigh, Shaofeng Yu, O.O. Olubuyide, J.L. Hoyt, and D.A. Antoniadis, "Tradeoff between mobility and subthreshold characteristics in dual-channel heterostructure n- and p-MOSFETs," *IEEE Electron Device Letters*, vol. 25, no. 8, p. 562, Aug. 2004.

Qing Hu

Professor

Department of Electrical Engineering and Computer Science

COLLABORATORS

J.L. Reno, Sandia National Lab

POSTDOCTORAL ASSOCIATE

B.S. Williams, MIT

GRADUATE STUDENTS

S.I. Kumar, Res. Asst., EECS

H. Callebaut, Res. Asst., EECS

A. Lee, Res. Asst., EECS

Q. Qin, Res. Asst., EECS

SUPPORT STAFF

C. Bourgeois, Admin. Asst.

PUBLICATIONS

A.W.M. Lee, B.S. Williams, S. Kumar, Q. Hu, and J.L. Reno, "Real-time imaging using a 4.3-THz quantum cascade laser and a 320×240 microbolometer focal-plane array," *IEEE Photonics Technology Letters*, to be published.

S. Kumar, B.S. Williams, Q. Hu, and J.L. Reno, "1.9-THz quantum-cascade lasers with one-well injector," *Applied Physics Letters*, vol. 88, pp. 121123:1-3, Mar. 2006.

B.S. Williams, S. Kumar, Q. Hu, and J.L. Reno, "High-power terahertz quantum-cascade lasers," *Electronics Letters*, vol. 42, no. 2, pp. 89-91, Jan. 2006.

B.S. Williams, S. Kumar, Q. Hu, and J.L. Reno, "Distributed-feedback terahertz quantum-cascade lasers using laterally corrugated metal waveguides," *Optics Letters*, vol. 30, no. 21, pp. 2909-2911, Nov. 2005.

H. Callebaut and Q. Hu, "Importance of coherence for electron transport in terahertz quantum cascade lasers," *Journal of Applied Physics*, vol. 98, pp. 104505:1-11, Nov. 2005.

A.W.M. Lee and Q. Hu, "Real-time, continuous-wave terahertz imaging using a microbolometer focal-plane array," *Optics Letters*, vol. 30, no. 19, pp. 2563-2565, Oct. 2005.

Q. Hu, B.S. Williams, S. Kumar, H. Callebaut, S. Kohen, and J.L. Reno, "Resonant-phonon-assisted THz quantum cascade lasers with metal-metal waveguides," *Journal of Semiconductor Science and Technology*, vol. 20, no. 7, pp. S228-S236, July 2005.

A.L. Betz, R.T. Boreiko, B.S. Williams, S. Kumar, Q. Hu, and J. L. Reno, "Frequency and phaselock control of a 3-THz quantum cascade laser," *Optics Letters*, vol. 30, no. 14, pp. 1837-1839, July 2005.

B.S. Williams, S. Kumar, Q. Hu, and J.L. Reno, "Operation of terahertz quantum-cascade lasers at 164 K in pulsed mode and at 117 K in continuous-wave mode," *Optics Express*, vol. 13, no. 9, pp. 3331-3339, May 2005.

S. Kohen, B.S. Williams, and Q. Hu, "Electromagnetic modeling of terahertz quantum cascade laser waveguides and resonators," *Journal of Applied Physics*, vol. 97, pp. 053106:1-9, Mar. 2005.

M.S. Vitiello, G. Scamarcio, B.S. Williams, S. Kumar, Q. Hu, and J.L. Reno, "Measurement of subband electronic temperatures and population inversion in THz quantum cascade lasers," *Applied Physics Letters*, vol. 86, pp. 111115:1-3, Mar. 2005.

Q. Hu, "Terahertz quantum cascade lasers," presented at the *Conference on Lasers and Electro-Optics/Quantum Electronics and Laser Science (CLEO/QELS)*, 2005.

Q. Hu, "High-temperature operation of THz quantum-cascade lasers," presented at the *Conference on Lasers and Electro-Optics Europe*, 2005.

Klavs F. Jensen

Lammot DuPont Professor

Department of Chemical Engineering and Materials Science

COLLABORATORS

M.G. Bawendi, MIT
S. Buchwald, MIT
A. Epstein, MIT
M. Kreuzer, MIT
C. Livermore, MIT
S. R. Manalis, MIT
M.A. Schmidt, MIT
A.J. Sinskey, MIT
T. Swager, MIT
P. Sorger, MIT
H.L. Tuller, MIT
B. Wardle, MIT
P. Seeberger, ETH

POSTDOCS

A. Adamo, ChemE
K. Deshpande, ChemE
J. El-Ali, ChemE
A. Guenther, ChemE,

GRADUATE STUDENTS

J. Albrecht, ChemE
B. Blackwell, ChemE
S.A. Khan, ChemE
E.V. Loewer, ChemE
P.P. McMullen, ChemE
E.R. Murphy, ChemE
O. Mattis Nielsen, EECS
Y. Olsson, DMSE
J. Rempel, ChemE
H. Sahoo, ChemE
M. Sultana, ChemE
L. Ye, ChemE
N. Zaborenko, ChemE
Z. Zhang, ChemE
B. K. Yen, ChemE

SUPPORT STAFF

J.A. Chisholm, Admin. Asst. II

PUBLICATIONS

F. Trachsel, A. Guenther, and S. Khan, and K.F. Jensen, "Measurement of residence time distribution in microfluidic systems," *Chem. Eng. Sci.*, vol. 60, no. 21, pp. 5729–5737, Nov. 2005.

N. De Mas, A. Guenther, T. Kraus, M.A. Schmidt, K.F. Jensen, "A microfabricated scaled-out multilayer gas-liquid microreactor with integrated velocimetry sensors," *Ind. Eng. Chem. Res.*, vol. 44, no. 24, pp. 8997-9013, Nov. 2005.

P. Boccazzi, A. Zanzotto, N. Szita, S. Bhattacharya, K.F. Jensen, and A.J. Sinskey, "Gene expression analysis of *Escherichia coli* grown in miniaturized bioreactor platforms for high-throughput analysis of growth and genomic data," *Applied Microbiology and Biotechnology*, vol. 68, no. 4, pp. 518–532, Sept. 2005.

J.Y. Rempel, B.L. Trout, M.G. Bawendi, and K.F. Jensen, "Properties of the CdSe(0001) (0001, and 1120) single crystal surfaces: relaxation, reconstruction, and adatom and admolecule adsorption," *J. Phys. Chem. B*, vol. 109, no. 41, pp. 19320-19328, Sept. 2005.

J.G. Kralj, E.R. Murphy, and K.F. Jensen, "Preparation of sodium nitrotetrazolate using microreactor technology," in *Proc. 41st AIAA/ASME/ASEE Joint Propulsion Conference*, Tucson, AZ, July 2005.

A.F. Lopeandia, L.I. Cerdó, M.T. Clavaguera-Mora, A.R. Arana, K.F. Jensen, F.J. Muñoz, and J. Rodriguez-Viejo, "Sensitive power compensated scanning calorimeter for analysis of phase transformations in small samples," *Rev. Sci. Instruments*, vol. 76, no. 065104: 1-5, June 2005.

K.F. Jensen and P.H. Seeberger, "Mikroreaktoren zur synthese und reaktionsoptimierung," *Nachrichten aus der Chemie*, vol. 53, pp. 628-631, June 2005.

B.K.H. Yen, A. Günther, M.A. Schmidt, K.F. Jensen, and M.G. Bawendi, "A microfabricated gas-liquid segmented flow reactor for high temperature synthesis: The case of CdSe quantum dots," *Angewandte Chemie International Edition*, vol. 44, no. 34, pp. 5447-5451, June 2005.

N. Szita, P. Boccazzi, Z. Zhang, P. Boyle, A.J. Sinskey, and K.F. Jensen, "Development of a multiplexed microbioreactor system for high-throughput bioprocessing," *Lab on a Chip*, vol. 5, pp. 819–826, June 2005.

J. El-Ali, S. Gaudet, A. Guenther, P.K. Sorger, and K.F. Jensen, "Rapid cell stimulus and lysis in a microfluidic device with segmented gas-liquid flow," *Analytical Chemistry*, vol. 77, no. 10, pp. 3629-3636, May 2005.

T.M. Floyd, M.A. Schmidt, and K.F. Jensen, "A silicon micromixer with infrared detection for studies of liquid phase reactions," *Industrial & Engineering Chemistry Research*, vol. 44, no. 8, pp. 2351-2358, Apr. 2005.

J.G. Kralj, M.A. Schmidt, and K.F. Jensen, "Sufactant-enhanced liquid-liquid extraction in microfluidic channels with inline electric-field enhanced coalescence," *Lab on a Chip*, vol. 5, pp. 531-535, Apr. 2005.

A. Guenther, M. Jhunjhunwala, M. Thalmann, M. A. Schmidt, and K. F. Jensen, "Micromixing of miscible liquids in Segmented gas-liquid flow," *Langmuir*, vol. 21, no. 4, pp. 1547-1555, Jan. 2005

H. Lu, M.A. Schmidt, and K.F. Jensen, "A microfluidic electroporation device for cell lysis," *Lab on a Chip*, vol. 5, pp. 23-29, Jan. 2005.

K.F. Jensen, "Silicon-based microreactors," in *ACS Symposium #941: Microreactor Technology and Process Intensification*, Y. Wang and J.D. Holladay, Eds. Washington, DC: American Chemical Society, 2005.

D.M. Ratner, E.R. Murphy, M. Jhunjhunwala, D.A. Snyder, K.F. Jensen, and P.H. Seeberger, "Microreactor-based reaction optimization in organic chemistry - Glycosylation as a challenge," *Chemical Communications*, vol. 5, pp. 578-570, Dec. 2004.

Roger D. Kamm

Germeshausen Professor of Mechanical and Biological Engineering
Department of Biological Engineering

COLLABORATORS

S. Chung, Postdoctoral Associate

GRADUATE STUDENTS

P. Mack, Res. Asst., BE

V. Vickerman, Res. Asst., BE

J. Hsu, Res. Asst., BE

PUBLICATIONS

B. Yap and R.D. Kamm, "Cytoskeletal remodeling and cellular activation during deformation of neutrophils into narrow channels," *Journal of Applied Physiology*, vol. 99, pp. 2323-2330, Dec. 2005.

B. Yap and R.D. Kamm, "Mechanical deformation of neutrophils into narrow channels induces pseudopod projection and changes in biomechanical properties," *Journal of Applied Physiology*, vol. 98, pp. 1930-1939, May 2005.

Sang-Gook Kim

Associate Professor

Department of Mechanical Engineering

COLLABORATORS

G. Chen, MIT
P. So, MIT
G. Barbastathis, MIT
M. Culpepper, MIT
L. Kimmerling, MIT
M. Schmidt, MIT
H. Lee, MIT
T. Akinwande, MIT
B. Wardle, MIT
S. Kumara, Penn State University
X. Zhang, UC Berkeley
S. Bukkapatnam, Oklahoma State University

GRADUATE STUDENTS

S. Doddabasanagouda, Res. Asst., ME
R. Xia, Res. Asst., EECS
Z. J. Traina, Res. Asst., ME
S. Kim, Res. Asst., ME

SUPPORT STAFF

R. Hardin, Admin. Asst.

PUBLICATIONS

W.C. Shih, S.G. Kim, and G. Barbastathis, "High resolution electrostatic analog tunable grating with a single-mask fabrication process," *Journal of Microelectromechanical Systems*, to be published.

W.J. Choi, Y. Jeon, J-H Jeong, R. Sood and S.G. Kim, "Energy harvesting MEMS devices based on thin film piezoelectric cantilevers," *Journal of Electroceramics*, to be published.

S.G. Kim, "Transplanting assembly of carbon nanotubes," *Annals of the CIRP*, vol. 55, no. 1, p.15, 2006.

J. Ueda, L. Odhner, S.G. Kim, H.H. Asada, "Local stochastic control of MEM-PZT cellular actuators with broadcast feedback," presented at the *First IEEE/RAS-EMBS International Conference on Biomedical Robotics and Biomechatronics*, 2006.

C. Mueller-Falcke, S.D. Gouda, S. Kim and S.G. Kim, "A nanoscanning platform for bio-engineering: An in-plane probe with switchable stiffness," *Nanotechnology*, vol. 17, no. 4, pp. 69-76, Feb. 2006.

N. DuToit, B.L. Wardle and S.G. Kim, "Design considerations for MEMS-scale piezoelectric mechanical vibration energy harvesters," *Integrated Ferroelectrics*, vol. 71, pp. 121-160, 2005.

Y.B. Jeon, R. Sood, J.H. Jeong and S.G. Kim, "MEMS power generator with transverse mode thin film PZT," *Sensors and Actuators A: Physical*, vol.122, no. 1, pp.16-22, July 2005.

S.G. Kim, G. Barbastathis, H.L. Tuller, "MEMS for Optical Functionality," in *Electroceramic-Based MEMS: Fabrication-Technology and Applications*, N. Setter, Ed. New York: Springer, 2005.

C. Mueller-Falcke, S.D. Gouda, S. Kim, and S.G. Kim, "Switchable stiffness nanoscanning probes for biological applications," presented at *Ninth International Conference on Miniaturized Systems for Chemistry and Life Sciences (μ TAS)*, 2005.

J.H. Jeong, Y.B. Jeon, R. Sood and S.G. Kim, "Energy harvesting devices based on d33 mode $\text{Pb}(\text{Zr,Ti})\text{O}_3$ thin film cantilevers," presented at the *2nd International Conference on Electroceramics*, 2005.

S.G. Kim, "Transplanting carbon nanotubes," presented at *ASME International Mechanical Engineering Congress and Exposition*, 2005.

Y. Shi, S. Xu, S.G. Kim and M. Libera, "Structural characteristics and piezoelectric properties of electrospun piezoelectric nanofibers," in *Proc. Materials Research Society Fall Meetings 2005*, Boston, MA, Nov. 2005, pp. 888-V08-06.1-888-V08-06.7.

Y. Shi, S. Xu and S.G. Kim, "Partially aligned piezoelectric nanofibers by sol-gel electrospinning process," presented at *4th ASME Integrated Nanosystems Conference*, 2005.

Y. Shi and S.G. Kim, "Micro undulated contact surfaces on the contact behavior of a MEMS switch," in *Proc. World Tribology Congress*, Washington D.C., Sept. 2005, paper no. WTC2005-63743.

C. Mueller-Falcke, S. D. Gouda, S. Kim, and S.G. Kim, "A nanoscanning platform for bio engineering," in *Proc. First International Conference on Bio-Nano-Informatics(BNI) Fusion*, Marina del Rey, CA, July 2005.

W.J. Choi, Y. Jeon, J-H Jeong, R. Sood and S.G. Kim, "Energy harvesting devices based on d33 mode $\text{Pb}(\text{Zr,Ti})\text{O}_3$ thin film cantilevers," in *Proc. Int'l Conference on Electroceramics*, Seoul, Korea, June 2005.

W.J. Choi, and S.G. Kim, "Energy harvesting MEMS device based on thin film piezoelectric cantilevers," in *Proc. 2nd International Workshop on Networked Sensing Systems, INSS 2005*, San Diego, CA, June 2005, p. 54.

S.G. Kim, "Assembly of carbon nanotubes; a mechanical way," in *NDSI 05: Conference on Nanoscale Devices and System Integration, IEEE Nanotechnology Council*, Houston, April 2005.

S.R.T. Kumara, S.G. Kim, X. Zhang, and S. Bukkapatnam, "Self-sustainable sensor networks for infrastructure and process integrity monitoring," in *Department of Homeland Security Conference*, Boston, MA, April 2005.

Leslie Kolodziejski

Professor

Department of Electrical Engineering and Computer Science

COLLABORATORS

S. Hamilton, Lincoln Laboratory
B. Robinson, Lincoln Laboratory
E.P. Ippen, MIT
J.D. Joannopoulos, MIT,
F.X. Kaertner, MIT
R. Ram, MIT
M. Soljagic, MIT
H.I. Smith, MIT

M. Dahlem, P. Rakich, S. Tandon,
M. Ibanescu, M. Soljagic, G. Petrich,
J. Joannopoulos, L. Kolodziejski, E.
Ippen, "Centimeter-Scale Super-
Collimation in a Large-Area 2-D
Photonic Crystal" in *Proc. of Conference
on Lasers and Electro-Optics (CLEO)*,
Long Beach, CA, May 2006.

RESEARCH STAFF

G. Petrich, Principal Research
Scientist

GRADUATE STUDENTS

R. Bryant, Res. Asst., EECS
A. Grine, Res. Asst., EECS
R. Williams, Res. Asst., DMSE
S. Young, Res. Asst., EECS

SUPPORT STAFF

C. Gibbs, Admin. Asst.
T. Kuhn, Admin. Asst.

PUBLICATIONS

P.T. Rakich, M.S. Dahlem, S. Tandon,
M. Ibanescu, M. Soljagic, G.S. Petrich,
J.D. Joannopoulos, L.A. Kolodziejski,
E.P. Ippen, "Achieving centimetre-
scale supercollimation in a large-area
two-dimensional photonic crystal"
Nature Materials, vol. 5, no. 2, pp. 93-6,
Feb. 2006.

F. J. Grawert, F.O. Ilay, D. Kielbinski,
J.T. Gopinath, G.S. Petrich, L.A.
Kolodziejski, E.P. Ippen, F.X. Kartner,
"Automatic feedback control of an Er-
doped fiber laser with an intracavity
loss modulator" *Optics Letters*, vol. 30,
no. 9, pp. 1066-1068, May 2005

F.J. Grawert, F.O. Ilay, D. Kielbinski,
J.T. Gopinath, G.S. Petrich, L.A.
Kolodziejski, E.P. Ippen, F.X. Kartner,
"Automatic feedback control of an Er-
doped fiber laser with an intracavity
loss modulator" in *Proc. of Conference
on Lasers and Electro-Optics (CLEO)*,
Baltimore, MD, vol. 3, no. 3, pp. 1656-
1658, May 2005.

Jing Kong

Assistant Professor

Department of Electrical Engineering and Computer Science

COLLABORATORS

M. Dresselhaus, MIT

J. Zhang, Chemistry, Peking University

Z.F.Liu, Chemistry, Peking University

GRADUATE STUDENTS

H.B. Son, Res. Asst., EECS

H. Farhat, Res. Asst., MSE

A.R. Cecco, Res. Asst., MSE

D.A. Nezich, Res. Asst., Physics

K.J. Lee, Res. Asst., EECS

SUPPORT STAFF

E. Moran, Admin. Asst.

PUBLICATIONS

Y.Y. Zhang, J. Zhang, H.B. Son, J. Kong, and Z.F. Liu, "Substrate-induced Raman frequency variation for single-walled carbon nanotubes," *Journal of the American Chemical Society*, vol. 127, no. 49, pp. 17156, Dec. 2005.

B.J. LeRoy, J. Kong, V.K. Pahilwani, C. Dekker, and S.G. Lemay, "Three-terminal scanning tunneling spectroscopy of suspended carbon Nanotubes," *Physics Review B*, vol. 72, pp. 075413:1-5, Aug. 2005.

P. Jarillo-Herrero, J. Kong, H.S.J. van der Zant, C. Dekker, L.P. Kouwenhoven, and S. De Franceschi, "Electronic transport spectroscopy of carbon nanotubes in a magnetic field," *Physics Review Letters*, vol. 94, pp. 156802: 1-4, Apr. 2005

S. Sapmaz, P. Jarillo-Herrero, J. Kong, C. Dekker, L.P. Kouwenhoven, and H.S.J. van der Zant, "Excitation spectrum of metallic carbon nanotubes," *Physics Review B*, vol. 71, pp. 153402:1-4, Apr. 2005.

J. Kong, B.J. LeRoy, S.G. Lemay, and C. Dekker, "Integration of a gate electrode into carbon nanotube devices for scanning tunneling microscopy," *Applied Physics Letters*, vol. 86, pp. 112106:1-3, Mar. 2005.

P. Jarillo-Herrero, J. Kong, H.S.J. van der Zant, C. Dekker, L.P. Kouwenhoven, and S. De Franceschi, "Orbital Kondo effect in carbon nanotubes," *Nature*, vol. 434, no. 7032, pp. 484-488, Mar. 2005.

I. Heller, J. Kong, H.A. Heering, K.A. Williams, S.G. Lemay, and C. Dekker, "Individual single-walled carbon nanotubes as nanoelectrodes for electrochemistry," *Nano Letters*, vol. 5, no. 1, pp. 137-142, Jan. 2005.

B.J. LeRoy, S.G. Lemay, J. Kong, and C. Dekker, "Electrical generation and absorption of phonons in carbon nanotubes," *Nature*, vol. 432, no. 7015, pp. 371-374, Nov. 2004.

B.J. LeRoy, S.G. Lemay, J. Kong, and C. Dekker, "Scanning tunneling spectroscopy of suspended single-wall carbon nanotubes," *Applied Physics Letters*, vol. 84, no. 21, pp. 4280-4282, May 2004.

Jeffrey H. Lang

Professor

Department of Electrical Engineering and Computer Science

COLLABORATORS

M.G. Allen, Georgia Institute of Technology
A.P. Chandrakasan, MIT
A.H. Epstein, MIT
R. Ghodssi, University of MD
F.S. Hover, MIT
S. Jacobson, MIT
D.J. Perreault, MIT
A.H. Slocum, MIT
M.S. Triantafyllou, MIT

GRADUATE STUDENTS

S. Hou, EECS
A. Weber, ME
B.C. Yen, EECS

SUPPORT STAFF

D. Bizi, Admin. Asst. I

PUBLICATIONS

M.P. Brenner, J.H. Lang, J. Li and, A.H. Slocum, "Optimum design of an electrostatic zipper actuator," in *Proc. 2004 NSTI Nanotechnology Conference and Trade Show*, Boston, MA, Mar. 2004, pp. 371-374.

J. Qiu, J.H. Lang, and A.H. Slocum, "A curved-beam bistable mechanism," *Journal of Microelectromechanical Systems*, vol. 13, no. 2, pp. 137-146, Apr. 2004.

C. Livermore, A. Forte, T. Lyszczarz, S.D. Umans, A.A. Ayon, and J.H. Lang, "A high-power MEMS electric induction motor," *Journal of Microelectromechanical Systems*, vol. 13, no. 3, pp. 465-471, June 2004.

D.P. Arnold, F. Cros, I. Zana, M. Allen, S. Das, and J.H. Lang, "Magnetic induction machines embedded in fusion-bonded silicon," in *Proc. Solid-State Sensor, Actuator and Microsystems Workshop*, Hilton Head, SC, June 2004, pp. 129-132.

S.M. Hou, J.H. Lang, A.H. Slocum, A.C. Weber and J.H. White, "A high-Q widely-tunable Gigahertz electromagnetic cavity resonator," in *Proc. Solid-State Sensor, Actuator and Microsystems Workshop*, Hilton Head, SC, June 2004, pp. 250-253.

J. Sihler, A.H. Slocum, and J.H. Lang, "An electrostatically actuated low-leakage silicon microvalve," in *Proc. Solid-State Sensor, Actuator and Microsystems Workshop*, Hilton Head, SC, June 2004, pp. 282-285.

J. Phinney, J.H. Lang, and D.J. Perreault, "Multi-resonant microfabricated inductors and transformers," in *Proc. Power Electronics Specialists Conference*, Aachen, Germany, June 2004, pp. 4527-4536.

X. Yang, A. Hoelke, S. Jacobson, J. H. Lang, M.A. Schmidt, and S.D. Umans, "An electrostatic on/off microvalve designed for gas fuel delivery for the MIT microengine," *Journal of Microelectromechanical Systems*, vol. 13, no. 4, pp. 660-668, Aug. 2004.

J.L. Steyn, S.H. Kendig, R. Khanna, T. Lyszczarz, S.D. Umans, J.U. Yoon, C. Livermore, and J.H. Lang, "Generating electric power with a MEMS electroquasistatic induction turbine generator," in *Proc. 18th IEEE International Conference on Micro Electro Mechanical Systems*, Miami, FL, Jan./Feb. 2005, pp. 614-617.

S. Das, D.P. Arnold, I. Zana, J.W. Park, J.H. Lang, and M.G. Allen, "Multi-Watt electric power from a microfabricated permanent magnet generator," in *Proc. 18th IEEE International Conference on Micro Electro Mechanical Systems*, Miami, FL, Jan./Feb. 2005, pp. 287-290.

J. Li, M.P. Brenner, T. Christen, M.S. Kotilainen, J.H. Lang and A.H. Slocum, "Deep-reactive ion-etched compliant starting zone electrostatic zipping actuators," *Journal of Microelectromechanical Systems*, vol. 14, no. 6, pp. 1283-1297, Dec. 2005.

S.F. Nagle, C. Livermore, L.G. Frechette, R. Ghodssi, and J.H. Lang, "An electric induction micromotor," *Journal of Microelectromechanical Systems*, vol. 14, no. 65 pp.1127-1143, Oct. 2005.

J. Qiu, J.H. Lang, and A.H. Slocum, "A bulk micromachined bistable relay

with U-shaped thermal actuators," *Journal of Microelectromechanical Systems*, vol. 14, no. 5, pp. 1099-1109, Oct. 2005.

D.P. Arnold, S. Das, F. Cros, I. Zana, M.G. Allen, and J.H. Lang, "Magnetic induction machines integrated into bulk-micromachined silicon," *Journal of Microelectromechanical Systems*, vol. 15, no. 2, pp. 406-414, Apr. 2006.

H. Koser, and J.H. Lang, "Magnetic induction micromachine-part I: Design and analysis," *Journal of Microelectromechanical Systems*, vol. 15, no. 2, pp. 415-426, Apr. 2006.

F. Cros, H. Koser, M.G. Allen, and J.H. Lang, "Magnetic induction micromachine-part II: fabrication and testing," *Journal of Microelectromechanical Systems*, vol. 15, no. 2, pp. 427-439, Apr. 2006.

H. Koser and J.H. Lang, "Magnetic induction micromachine-part III: Eddy currents and nonlinear effects," *Journal of Microelectromechanical Systems*, vol. 15, no. 2, pp. 440-456, Apr. 2006.

Hae-Seung Lee

Professor

Department of Electrical Engineering and Computer Science

COLLABORATORS

P. Holloway, National Semiconductor

GRADUATE STUDENTS

L. Brooks, Res. Asst., EECS

A. Chen, Res. Asst., EECS

A. Chow, Res. Asst., EECS

J. Fiorenza, Res. Asst., EECS

M. Guyton, Res. Asst., EECS

T. Sepke, Res. Asst., EECS

M. Spaeth, Res. Asst., EECS

VISITING SCIENTISTS

H.-Y. Lee, Samsung Electronics

S.-T. Ryu, Samsung Electronics

SUPPORT STAFF

C. Collins, Assistant to Director of
Center for Integrated Circuits and
Systems

PUBLICATIONS

T. Sepke, J.K. Fiorenza, C.G. Sodini, P. Holloway and H.-S. Lee, "Comparator-based switched-capacitor circuits for scaled CMOS technologies," *IEEE Journal of Solid-State Circuits*, accepted for publication.

T. Sepke, J.K. Fiorenza, C.G. Sodini, P. Holloway and H.-S. Lee, "Comparator-based switched-capacitor circuits for scaled CMOS technologies," in *IEEE International Solid-State Circuits Conference Digest of Technical Papers*, San Francisco, CA, Feb. 2006, pp. 220-221.

J. Yang, K.G. Fife, L. Brooks, C.G. Sodini, A. Betts, P. Mudunuru, and H.-S. Lee, "A 3 megapixel, low-noise flexible architecture CMOS image sensor," in *IEEE International Solid-State Circuits Conference Digest of Technical Papers*, San Francisco, CA, Feb. 2006, pp. 496-497.

A. Chen, A.I. Akinwande, and H.-S. Lee, "A CMOS-based microdisplay with calibrated backplane," *IEEE Journal of Solid-State Circuits*, vol. 40, no. 12, pp. 2746-2755, Dec. 2005.

A. Chen, A.I. Akinwande, and H.-S. Lee, "A CMOS-based microdisplay with calibrated backplane," in *IEEE International Solid-State Circuits Conference Digest of Technical Papers*, San Francisco, CA, Feb. 2005, pp. 552-617.

Carol Livermore

Assistant Professor

Department of Mechanical Engineering

COLLABORATORS

A. Epstein, MIT
K. Jensen, MIT

GRADUATE STUDENTS

F. Eid, Res. Asst., ME
T. Hill, Res. Asst., EECES
S. Jung, Res. Asst., ME
N. Shaar, Res. Asst., ME

SUPPORT STAFF

S. Bunker, Admin. Asst. I

PUBLICATIONS

T.F. Hill, B.A. Wilhite, L.F. Velasquez-Garcia, A.H. Epstein, K.F. Jensen, and C. Livermore, "A MEMS singlet oxygen generator," presented at *Solid State Sensor, Actuator, and Microsystems Workshop*, 2006.

S. Jung and C. Livermore, "Achieving selective assembly with template topography and ultrasonically induced fluid forces," *Nano Letters* vol. 5, no. 11, pp. 2188-2194, Nov. 2005.

S.F. Nagle, C. Livermore, L.G. Frechette, R. Ghodssi, and J.H. Lang, "An electric induction micromotor," *Journal of Microelectromechanical Systems*, vol. 14, no. 5, pp. 1127-1143, Oct. 2005.

Steyn, J.L., S.H. Kendig, R. Khanna, T.M. Lyszczarz, S.D. Umans, J.U. Yoon, C. Livermore, and J.H. Lang, "Generating electric power with a MEMS electroquasistatic induction turbine-generator," in *Proc. 18th IEEE International Conference on Micro Electro Mechanical Systems*, Miami, FL, Jan./Feb. 2005, pp. 614-617.

Wilhite, B.A., C. Livermore, Y. Gong, A.H. Epstein, and K.F. Jensen, "Design of a MEMS-based microchemical oxygen iodine laser system," *IEEE Journal of Quantum Electronics*, vol. 40, no. 8, pp. 1041-1055, Aug. 2004.

C. Livermore, A. Forte, T. Lyszczarz, S.D. Umans, A.A. Ayon, and J.H. Lang, "A High-power MEMS electric induction micromotor," *IEEE Journal of Microelectromechanical Systems*, vol. 13, no. 3, pp. 465-471, June 2004.

T.C. Neugebauer, D.J. Perreault, J.H. Lang, C. Livermore, "A six-phase multilevel interter for MEMS electrostatic induction micromotors," *IEEE Transactions on Circuits and Systems II*, vol. 51, no. 2, pp. 49-56, Feb. 2004.

C. Livermore, A. Forte, T. Lyszczarz, S.D. Umans, and J. Lang, "Microscale electric induction machines for power applications," in *Proc. Electrostatics 2003*, Edinburgh, Scotland, Mar. 2003, pp. 45-52.

C. Livermore, D.S. Duncan, R.M. Westervelt, K.D. Maranowski, and A.C. Gossard, "Measuring interactions between tunnel-coupled quantum dots in the quantum Hall regime," *Journal of Applied Physics*, vol. 86, no. 7, pp. 4043-4045, Oct. 1999.

A.S. Adourian, C. Livermore, R.M. Westervelt, K.L. Campman, and A.C. Gossard, "Evolution of Coulomb blockade spectra in parallel coupled quantum dots," *Applied Physics Letters*, vol. 75, no. 3, pp. 424-426, July 1999.

C. Livermore, D.S. Duncan, R.M. Westervelt, K.D. Maranowski, and A.C. Gossard, "Conductance oscillations in tunnel-coupled quantum dots in the quantum Hall regime," *Physical Review B*, vol. 59, no. 16, pp. 10744-10747, Apr. 1999.

D.S. Duncan, C. Livermore, R.M. Westervelt, K.D. Maranowski, and A.C. Gossard, "Direct measurement of the destruction of charge quantization in a single electron box," *Applied Physics Letters*, vol. 74, no. 7, pp. 1045-1047, Feb. 1999.

C.H. Crouch, C. Livermore, R.M. Westervelt, K.L. Campman, and A.C. Gossard, "Evolution of the Coulomb gap in tunnel-coupled quantum dots," *Applied Physics Letters*, vol. 71, no. 6, pp. 817-819, Aug. 1997.

C. Livermore, C.H. Crouch, R.M. Westervelt, K.L. Campman, and A.C. Gossard, "The Coulomb blockade in coupled quantum dots," *Science*, vol. 274, no. 5291, pp. 1332-1335, Nov. 1996.

Scott R. Manalis

Associate Professor

Department of Biological and Mechanical Engineering

COLLABORATORS

J. Han, MIT
R. Sasisekharan, MIT
P. So, MIT
S. Suresh, MIT

POSTDOCTORAL SCIENTISTS

T. Burg, Res. Asst., BE
M. Godin, Res. Asst., BE
N. Milovic, Res. Asst., BE

GRADUATE STUDENTS

A. Bryan, BE
R. Chunara, HST and EECS
P. Dextras, BE
J. Hou, EECS
K.M. Naegle, BE
M. von Muhlen, BE

PUBLICATIONS

T.P. Burg, A.R. Mirza, N. Milovic, C.H. Tsau, G.A. Popescu, J.S. Foster, and S.R. Manalis, "Vacuum packaged suspended microchannel resonant mass sensor for biomolecular detection," *IEEE Journal of Microelectromechanical Systems*, to be published.

C.J. Hou, N. Milovic, M. Godin, P.R. Russo, R. Chakrabarti, and S.R. Manalis, "Label-free microelectronic PCR quantification," *Analytical Chemistry*, vol. 78, no. 8, pp. 2526-2531, Mar. 2006.

A.W. Sparks and S.R. Manalis, "Atomic force microscopy with inherent disturbance suppression for nanostructure imaging," *Nanotechnology*, vol. 17, no. 6, pp. 1574-1579, Mar. 2006.

Ichiro Masaki

Director

Intelligent Transportation Research Center

COLLABORATORS

J.F. Coughlin, MIT
B.K.P. Horn, MIT
H.-S. Lee, MIT
C.G. Sodini, MIT
J.M. Sussman, MIT

GRADUATE STUDENTS

Y. Fang, Res. Asst., EECS

SPECIAL STUDENT

M.T. Farrell, EECS

VISTING SCIENTIST

M. Ito, National Police Agency, Japan

SUPPORT STAFF

M. Flaherty, Admin. Asst. II

PUBLICATIONS

Y. Fang, K. Yamada, Y. Ninomiya, B. Horn and I. Masaki, "A shape-independent-method for pedestrian detection with far infrared-images," *IEEE Transactions on Vehicular Technology*, vol. 53, no. 6, pp.1679-1697, Nov. 2004.

Y. Fang, I. Masaki, and B.K.P. Horn, "Depth-based target segmentation for intelligent vehicles: Fusion of radar and binocular stereo," *IEEE Transactions on Intelligent Transportation Systems*, vol. 3, no. 3, pp.196-202, Sept. 2002.

W.F. Herrington, Jr., B.K.P. Horn, and I. Masaki, "Application of the discrete Haar wavelet transform to image fusion for nighttime driving," in *Proc. Intelligent Vehicles Symposium 2005*, Las Vegas, NV, June 2005, pp. 273-277.

Y. Fang, K. Yamada, Y. Ninomiya, B.K.P. Horn, and I. Masaki, "Comparison between infrared-image-based and visible-image-based approaches for pedestrian detection," in *Proc. Intelligent Vehicles Symposium 2003*, Columbus, OH, June 2003, pp. 505-510.

Y. Fang, I. Masaki, and B. Horn, "Distance/motion based segmentation under heavy background noise," *IEEE Intelligent Vehicles Symposium*, June 2002, pp. 483-488.

Y. Fang, Y. Ninomiya, and I. Masaki, "Intelligent transportation systems, challenges and opportunities," *The 2nd International Symposium on Multimedia Mediation Systems*, Mar. 2002, pp.72-77.

Y. Fang, I. Masaki, and B. Horn, "Distance range based segmentation in intelligent transportation systems: Fusion of radar and binocular stereo," *IEEE Intelligent Vehicles Symposium*, May 2001, pp.171-176.

Terry P. Orlando

Professor

Department of Electrical Engineering and Computer Science

COLLABORATORS

W.D. Oliver, MIT
K.K. Berggren, MIT
L.S. Levitov, MIT
S. Lloyd, MIT
J.E. Mooij, Delft U. of Technology,
The Netherlands
K. Segall, Colgate U.
M. Tinkham, Harvard U.
S.O. Valenzuela, MIT
M.J. Feldman, U. of Rochester
M.F. Bocko, U. of Rochester
J.L. Habif, MIT
Y. Yu, MIT
J.J. Mazo, U. of Zaragoza, Spain

GRADUATE STUDENTS

D.M. Berns, Res. Asst., Physics
B.M. Cord, Res. Asst., EECS
W.M. Kaminsky, Res. Asst., Physics
K.V.R.M. Murali, Res. Asst., EECS
J.C. Lee, Res. Asst., EECS

SUPPORT STAFF

G. Hall, Admin. Asst.

PUBLICATIONS

W.D. Oliver, Y. Yu, J.C. Lee, K.K. Berggren, L.S. Levitov, and T.P. Orlando, "Mach-Zehnder interferometry in a strongly driven superconducting qubit," *Science*, vol. 310, no. 5754, pp. 1653-1657, Dec. 2005.

D.M. Berns and T.P. Orlando, "Implementation schemes for the factorized quantum lattice-gas algorithm for the one dimensional diffusion equation using persistent-current qubits," *Quantum Information Processing*, vol. 4, no. 4, pp. 265-282, Oct. 2005.

K. Segall, J.J. Mazo, and T.P. Orlando, "Multiple junction biasing of superconducting tunnel junction detectors," *Applied Physics Letters*, vol. 86, pp. 153507:1-3, Apr. 2005.

P. Hagedorn, S.D. Senturia, and T.P. Orlando, *Introductory Applied Quantum and Statistical Mechanics*. New York: John Wiley & Sons, Inc., 2004.

K.V.R.M. Murali, Z. Dutton, W.D. Oliver, D.S. Crankshaw, and T.P. Orlando, "Probing decoherence with electromagnetically induced transparency in superconductive quantum circuits," *Physical Review Letters*, vol. 93, no. 8, pp. 087003, Aug. 2004.

D.S. Crankshaw, K. Segall, D. Nakada, T.P. Orlando, L.S. Levitov, S. Lloyd, S.O. Valenzuela, N. Markovic, M. Tinkham, and K.K. Berggren, "DC measurements of macroscopic quantum levels in a superconducting qubit structure with a time-ordered meter," *Physical Review B*, vol. 69, no. 14, pp. 144518:1-9, Apr. 2004.

Y. Yu, D. Nakada, J.C. Lee, B. Singh, D.S. Crankshaw, T.P. Orlando, W.D. Oliver, and K.K. Berggren, "Energy relaxation time between macroscopic quantum levels in a superconducting persistent-current qubit," *Physical Review Letters*, vol. 92, no. 11, pp. 117904:1-4, Mar. 2004.

J.J. Mazo and T.P. Orlando, "Discrete breathers in Josephson arrays," *Chaos*, vol. 13, no. 2, pp. 733-743, June 2003.

D. Nakada, K.K. Berggren, R. Macedo, V. Liberman, and T.P. Orlando, "Improved critical-current-density uniformity by using anodization," *IEEE Transactions on Applied Superconductivity*, vol. 13, no. 2, pp. 111-114, Part 1, June 2003.

D.S. Crankshaw, J.L. Habif, X. Zhou, T.P. Orlando, M.J. Feldman, and M.F. Bocko, "An RSFQ variable duty cycle oscillator for driving a superconductive qubit," *IEEE Transactions on Applied Superconductivity*, vol. 13, no. 2, pp. 966-969, Part 1, June 2003.

K. Segall, D.S. Crankshaw, D. Nakada, B. Singh, J. Lee, T.P. Orlando, K.K. Berggren, N. Markovic, and M. Tinkham, "Experimental characterization of the two current states in a Nb persistent current qubit," *IEEE Transactions on Applied Superconductivity*, vol. 13, no. 2, pp. 1009-1012, Part 1, June 2003.

L. Tian, S. Lloyd, and T.P. Orlando, "Projective measurement scheme for solid-state qubits," *Physical Review B*, vol. 67, no. 22, pp. 220505:1-4, June 2003.

K. Segall, D. Crankshaw, D. Nakada, T.P. Orlando, L.S. Levitov, S. Lloyd, N. Markovic, S.O. Valenzuela, M. Tinkham, and K.K. Berggren, "Impact of timeordered measurements of the two states in a niobium superconducting qubit structure," *Physical Review B*, vol. 67, no. 22, pp. 220506:1-4, June 2003.

Michael H. Perrott

Assistant Professor

Department of Electrical Engineering and Computer Science

COLLABORATORS

F. Kaertner, MIT

G. Wei, Harvard

GRADUATE STUDENTS

B. Helal, Res. Asst., EECS

C. Hsu, Res. Asst., EECS

K. Johnson, Res. Asst., EECS

C. Lau, Res. Asst., EECS

M. Park, Res. Asst., EECS

M. Park, Res. Asst., EECS

M. Straayer, Res. Asst., EECS

SUPPORT STAFF

V. DiNardo, Admin. Asst.

PUBLICATIONS

S.E. Meninger, M.H. Perrott, "A 1-MHz bandwidth 3.6-GHz 0.18- μ m CMOS fractional-N synthesizer utilizing a hybrid PFD/DAC structure for reduced broadband phase noise," *IEEE Journal of Solid-State Circuits*, vol. 41, no. 4, pp. 966-980, Apr. 2006.

E.A. Crain and M.H. Perrott, "A 3.125 Gb/s limit amplifier in CMOS with 42 dB gain and 1 μ s offset compensation," *IEEE Journal of Solid-State Circuits*, vol. 41, no. 2, pp. 443-451, Feb. 2006.

S.E. Meninger and M.H. Perrott, "A dual band 1.8GHz/900MHz, 750 kb/s GMSK transmitter utilizing a hybrid PFD/DAC structure for reduced broadband phase noise," *IEEE Symposium on VLSI Circuits Digest of Technical Papers*, June 2005, pp. 394-397.

S.E. Meninger and M.H. Perrott, "Bandwidth extension of low noise fractional-N synthesizers," *IEEE Radio Frequency Integrated Circuits Symposium Digest of Technical Papers*, June 2005, pp. 211-214.

E. Crain and M.H. Perrott, "A 3.125 Gb/s limit amplifier with 42dB gain and 1 μ s offset compensation in 0.18 μ m CMOS," in *Proc. International Solid-State Circuits Conference*, San Francisco, CA, Feb. 2005, pp. 232-233.

J. Kim, F.X. Kaertner, and M.H. Perrott, "Femtosecond synchronization of radio frequency signals with optical pulse trains," *Optics Letters*, vol. 29, no. 17, pp. 2076-2078, Sept. 2004.

E.A. Crain and M.H. Perrott, "A numerical design approach for high-speed, differential, resistor-loaded, CMOS amplifiers," presented at *IEEE International Symposium on Circuits and Systems*, 2004.

S.E. Meninger and M.H. Perrott, "A fractional-N frequency synthesizer architecture utilizing a mismatch compensated PFD/DAC structure for reduced quantization-induced phase noise," *IEEE Transactions on Circuits and Systems II: Analog and Digital Signal Processing*, vol. 50, no. 11, pp. 839-849, Nov. 2003.

C.Y. Lau and M.H. Perrott, "Phase locked loop design at the transfer function level based on a direct closed loop realization algorithm," in *Proc. 40th Design Automation Conference*, Anaheim, CA, June 2003, pp. 526-531.

M.H. Perrott, M.D. Trott, and C.G. Sodini, "A modeling approach for sigma-delta fractional-N frequency synthesizers allowing straightforward noise analysis," *Journal of Solid-State Circuits*, vol. 37, no. 8, pp. 1028-1038, Aug. 2002.

M.H. Perrott, "Fast and accurate behavioral simulation of fractional-N synthesizers and other PLL/DLL circuits," in *Proc. 39th Design Automation Conference*, New Orleans, LA, June 2002, pp. 498-503.

Rajeev Ram

Associate Professor

Department of Electrical Engineering and Computer Science

COLLABORATORS

A. Sinskey, MIT

R. Kirchain, MIT

A. Gossard, UCSB

J. Hudgings, Mount Holyoke College

P. Mayer and R.J. Ram, "Thin-film thermoelectric generator element characterization," in *Proc. 24th International Conference on Thermoelectrics*, Clemson, SC, June 2005, pp. 280-283.

POST DOCTORATES

X. Guo, EECS

H.T.L. Lee, EECS

GRADUATE STUDENTS

R. Amatya, Res. Asst., EECS

K.S.K. Lee, Res. Asst., EECS

T. Liptay, Res. Asst., EECS

P. Mayer, Res. Asst., EECS

J. Orcutt, Res. Asst., EECS

T. Zaman, Res. Asst., EECS

SUPPORT STAFF

C. Bourgeois, Admin. Asst. I

PUBLICATIONS

E. Fuchs, E.J. Bruce, R.J. Ram, and R.E. Kirchain, "Process based cost modeling of photonics manufacture: The cost competitiveness of monolithic integration of a 1550nm DFB laser and an electro-absorptive modulator on an InP platform" *IEEE Journal of Lightwave Technology*, to be published.

T. Zaman, X. Guo, and R.J. Ram, "Polarization independent integrated optical circulator", *IEEE Photonics Technology Letters*, to be published.

H.L.T. Lee and R.J. Ram, "Integrated fluid injectors and mixers for pH control in miniature bioreactor arrays," in *Proc. Ninth International Conference on Miniaturized Systems for Chemistry and Life Sciences (μ TAS)*, Boston, MA, Sept 2005, pp. 34-36.

P. Mayer and R.J. Ram, "Cross-plane thermoreflectance imaging of thermoelectric elements," in *Proc. Materials Research Symposium*, Boston, MA, Dec. 2005, pp. F10-06:1-6.

Caroline A. Ross

Professor

Department of Materials Science and Engineering

COLLABORATORS

H.I. Smith, MIT
C. Thompson, MIT
E.L. Thomas, MIT
A. Mayes, MIT
R.C. O'Handley, MIT
G. Dionne, Lincoln Lab
G.J. Vancso, U. Twente
C. Pike, UC Davis
J.A.C. Bland, U. of Cambridge
R. Dunin-Borkowski, U. of Cambridge
M. Pardavi-Horvath, George Washington U.
R.D. McMichael, NIST
A. Petford-Long, Oxford U.

POSTDOCTORAL ASSOCIATES

F.J. Castaño
M. Bolduc
J.D. Suh

GRADUATE STUDENTS

V. Chuang, Res. Asst., MSE
F. Ilievski, Res. Asst., MSE
W. Jung, Res. Asst., MSE
Y.S. Jung, Res. Asst., MSE
E. Lyons, Res. Asst., MSE
D. Morecroft, Res. Asst., MSE
V. Sivakumar, Res. Asst., MSE

SUPPORT STAFF

G. Joseph, Admin. Asst. II

PUBLICATIONS

M. Pardavi-Horvath, C.A. Ross, and R.D. McMichael, "Shape effects in the ferromagnetic resonance of nanosize rectangular permalloy arrays," *IEEE Transactions on Magnetics*, vol. 41, no. 10, pp. 3601-3603, Oct. 2005.

A. Rajamani, G. Dionne, D. Bono, and C.A. Ross, "Faraday rotation, ferromagnetism, and optical properties in Fe-doped BaTiO₃," *Journal of Applied Physics*, vol. 98, pp. 063907:1-5, Sept. 2005.

F.J. Castaño, D. Morecroft, W. Jung and C.A. Ross, "Spin-dependent scattering in multilayered magnetic rings," *Physical Review Letters*, vol. 95, pp. 137201:1-4, Sept. 2005.

T.J. Bromwich, A. Kohn, A.K. Petford-Long, T. Kasama, R. Dunin-Borkowski, S. Newcomb, and C.A. Ross, "Remanent magnetization states and interactions in square arrays of 100 nm cobalt dots measured using transmission electron microscopy," *Journal of Applied Physics*, vol. 98, pp. 053909:1-8, Sept. 2005.

K. Nielsch, F.J. Castaño, C.A. Ross, and R. Krishnan, "Magnetic properties of template-synthesized cobalt/polymer composite nanotubes," *Journal of Applied Physics*, vol. 98, pp. 034318:1-7, Aug. 2005.

T. Kasama, R. Dunin-Borkowski, S.B. Newcomb, M.R. McCartney, F.J. Castaño and C.A. Ross, "Off-axis electron holography of pseudo-spin-valve thin film magnetic elements," *Journal of Applied Physics*, vol.98, pp. 013903:1-7, July 2005.

W. Jung, F.J. Castaño, D. Morecroft, C.A. Ross, R. Menon, and H.I. Smith, "Magnetization reversal in single-layer and exchange-biased elliptical-ring arrays," *Journal of Applied Physics*, vol. 97, pp. 10K113:1-3, May 2005.

C. Pike, C.A. Ross, R.T. Scalettar, and G. Zimanyi, "First order reversal curve diagram analysis of a perpendicular nickel nanopillar array," *Physical Review B*, vol. 71, no. 13, pp. 134407:1-12, Apr. 2005.

K. Nielsch, F.J. Castaño, S. Matthias, W. Lee, and C.A. Ross, "Synthesis of cobalt/polymer multilayer nanotubes," *Advanced Engineering Materials*, vol. 7, no. 4, pp. 217-221, Apr. 2005.

C.A. Ross, F.J. Castaño, E. Rodriguez, S. Haratani, B. Vögeli and H.I. Smith, "Size-dependent switching of multilayer magnetic elements," *Journal of Applied Physics*, vol. 97, pp. 053902:1-6, Mar. 2005.

T. Moore, T.J. Hayward, D.H.Y. Tse, J.A.C. Bland, F.J. Castaño, and C.A. Ross, "Magnetization reversal in individual micrometer sized polycrystalline permalloy rings," *Journal of Applied Physics*, vol.97, pp. 063910:1-5, Mar. 2005.

G.F. Dionne, G.A. Allen, P.R. Haddad, C.A. Ross, and B. Lax, "Circular Polarization and Nonreciprocal Propagation in Magnetic Media," *Lincoln Lab Journal*, vol. 15, no. 2, pp. 323-340, 2005.

H.J. Jang, P. Eames, E. Dan Dahlberg, M. Farhoud, and C.A. Ross, "Magnetostatic interaction of cylindrical single domain nanopillars in quasi-static magnetization states," *Applied Physics Letters*, vol. 86, pp. 023102:1-3, Jan. 2005.

Rahul Sarpeshkar

Associate Professor

Department of Electrical Engineering and Computer Science

POSTDOCTORAL ASSOCIATE

L. Turicchia, EECS

GRADUATE STUDENTS

S. Arfin, Res. Asst., EECS

M. Baker, Res. Asst., EECS

T. Lu, Res. Asst., EECS

S. Mandal, Res. Asst., EECS

M. O'Halloran, Res. Asst., EECS

C. Salthouse, Res. Asst., EECS

A. Selbst, Res. Asst., EECS

J.J. Sit, Res. Asst., EECS

M. Tavakoli-Dastjerdi, Res. Asst., EECS

W. Wattanapanitch, Res. Asst., EECS

K.H. Wee, Res. Asst., EECS

H. Yang, Res. Asst., EECS

S. Zhak, Res. Asst., EECS

SUPPORT STAFF

G. Jones, Admin. Asst.

PUBLICATIONS

M. O'Halloran and R. Sarpeshkar, "An analog storage cell with 5 electron/sec leakage," presented at the *IEEE International Symposium on Circuits and Systems*, 2006.

S. Mandal, S. Zhak, and R. Sarpeshkar, "Circuits for an RF cochlea," presented at the *IEEE International Symposium on Circuits and Systems*, 2006.

B. Kim, S. Mandal, and R. Sarpeshkar, "Power-adaptive operational amplifier with positive-feedback self biasing," presented at the *IEEE International Symposium on Circuits and Systems*, 2006.

S. Mandal, S.K. Arfin, and R. Sarpeshkar, "Fast startup CMOS current references," presented at the *IEEE International Symposium on Circuits and Systems*, 2006.

P. Loizou, K. Kasturi, T. Turicchia, R. Sarpeshkar, M. Dorman, and T. Spahr, "Evaluation of the companding and other strategies for noise reduction in cochlear implants," presented at the *Conference on Implantable Auditory Prostheses*, 2005.

H. Yang and R. Sarpeshkar, "A time-based energy-efficient analog-to-digital converter," *IEEE Journal of Solid-State Circuits*, vol. 40, no. 8, pp. 1590-1601, Aug. 2005.

A.M. Simonson, A.J. Oxenham, L. Turicchia, and R. Sarpeshkar, "Evaluation of companding-based spectral enhancement using simulated cochlear implant processing," presented at the *Meeting of the American Auditory Society*, 2006.

Mark L. Schattenburg
Senior Research Scientist
MIT Kavli Institute

COLLABORATORS

H.I. Smith, MIT
D. Smith, PGL
D. Trumper, MIT
R. Hocken, UNCC

GRADUATE STUDENTS

M. Ahn, Res. Asst., ME
M. Akilian, Res. Asst., ME
C.-H. Chang, Res. Asst., ME
J. Montoya, Res. Asst., EECS
Y. Zhao, Res. Asst., ME

SUPPORT STAFF

R. Fleming, Lab Manager
R. Heilmann, Lab Asst. Director
Y.-O. Jung, Visiting Engineer

PUBLICATIONS

R.K. Heilmann, M. Akilian, C.-H. Chang, C.G. Chen, C. Forest, C. Joo, P. Konkola, J.C. Montoya, Y. Sun, J. You and M.L. Schattenburg, "Advances in reflection grating technology for Constellation-X," in *Proc. SPIE Optics for EUV, X-ray, and Gamma-ray Astronomy*, San Diego, CA, Aug. 2003, pp. 271-282.

R.K. Heilmann, C.G. Chen, P.T. Konkola and M.L. Schattenburg, "Dimensional metrology for nanometer-scale science and engineering: Towards sub-nanometer accurate encoders," *Nanotechnology*, vol. 15, no. 10, pp. S504-S511, Oct. 2004.

C.-H. Chang, J.C. Montoya, M. Akilian, A. Lapsa, R.K. Heilmann, M.L. Schattenburg, M. Li, K.A. Flanagan, A.P. Rasmussen, J.F. Seely, J.M. Laming, B. Kjornrattanawanich and L.I. Goray, "High fidelity blazed grating replication using nanoimprint lithography," *Journal of Vacuum Science and Technology B*, vol. 22, no. 6, pp. 3260-3264, Nov. 2004.

R.K. Heilmann, M. Akilian, C.-H. Chang, C.R. Forest, C. Joo, A. Lapsa, J.C. Montoya and M.L. Schattenburg, "Thin foil reflection gratings for Constellation-X," in *Proc. UV and Gamma-Ray Space Telescope Systems*, Glasgow, Scotland, June 2004, pp. 283-290.

M. Akilian, C. Forest, A. Slocum, D. Trumper and M.L. Schattenburg, "Thin optics constraint," in *Proc. 19th Annual Meeting of the American Society for Precision Engineering*, Orlando, FL, Oct. 2004, pp. 209-212.

J. Montoya, R.K. Heilmann and M.L. Schattenburg, "Measuring two-axis stage mirror non-flatness using linear/angular interferometers," in *Proc. 19th Annual Meeting of the American Society for Precision Engineering*, Orlando, FL, Oct. 2004, pp. 382-385.

C.R. Canizares, J. Davis, D. Dewey, K.A. Flanagan, E. Galton, D.P. Huenemoerder, K. Ishibashi, T.L. Markert, H.L. Marshall, M. McGuirk, M.L. Schattenburg, N.S. Schulz, H.I. Smith and M. Wise, "The *Chandra* high-energy transmission grating: Design, fabrication and ground calibration and five years in flight," *Publications of the Astronomical Society of the Pacific*, vol. 117, no. 836, pp. 1144-1171, Oct. 2005.

J. Montoya, C.-H. Chang, R.K. Heilmann and M.L. Schattenburg, "Doppler writing and linewidth control for scanning beam interference lithography," *Journal of Vacuum Science and Technology B*, vol. 23, no. 6, pp. 2640-2645, Nov. 2005.

Y. Zhao, C.-H. Chang, J. Montoya, R.K. Heilmann and M.L. Schattenburg, "Measurement of milli-degree temperature gradients in environmental enclosures," in *Proc. 20th Annual Meeting of the American Society for Precision Engineering*, Norfolk, VA, Oct. 2005, pp. 226-229.

C.-H. Chang, R.K. Heilmann and M.L. Schattenburg, "Advanced heterodyne fringe-locking system using multiple frequency shifts," in *Proc. of the 20th Annual Meeting of the American Society for Precision Engineering*, Norfolk, VA, Oct. 2005, pp. 375-378.

R.K. Heilmann, M. Akilian, C.-H. Chang, R. Hallock, E. Cleveland and M.L. Schattenburg, "Shaping of thin grazing-incidence reflection grating substrates via magnetorheological finishing," in *Proc. Optics for EUV, X-ray, and Gamma-ray Astronomy II*, San Diego, CA, Aug. 2005, pp. 590009:1-7.

C.-H. Chang, M. Akilian and M.L. Schattenburg, "Describing isotropic and anisotropic out-of-plane deformations in thin cubic materials using Zernike polynomials," *Applied Optics*, vol. 45, no. 3, pp. 432-437, Jan. 2006.

M.P. Kowalski, R.K. Heilmann, M.L. Schattenburg, C.-H. Chang, F.B. Berendse and W.R. Hunter, "Near-normal-incidence extreme-ultraviolet efficiency of a flat crystalline anisotropically etched blazed grating," *Applied Optics*, vol. 45, no. 8, pp. 1676-1679, Mar. 2006.

J.F. Seely, L.I. Goray, B. Kjornrattanawanich, J.M. Laming, G.E. Holland, K.A. Flanagan, R.K. Heilmann, C.-H. Chang, M.L. Schattenburg and A.P. Rasmussen, "Efficiency of a grazing-incidence off-plane grating in the soft x-ray region," *Applied Optics*, vol. 45, no. 8, pp. 1680-1687, Mar. 2006.

C.R. Forest, M. Spenko, Y. Sun, A.H. Slocum, R.K. Heilmann and M.L. Schattenburg, "Repeatable and accurate assembly of x-ray foil optics," *Journal of Precision Engineering*, vol. 30, no. 1, pp. 63-70, Jan. 2006.

Martin A. Schmidt

Professor

Department of Electrical Engineering and Computer Science

COLLABORATORS

A. Akindwande, MIT
V. Bulovic, MIT
A. Epstein, MIT
K.F. Jensen, MIT

GRADUATE STUDENTS

K. Cheung, Res. Asst., EECS
A. Gerhardt, Res. Asst., EECS
V. Leblanc, Res. Asst., DMSE
O. Mattis Nielsen, Res. Asst., EECS
V. Sharma, Res. Asst., EECS

ADMINISTRATIVE STAFF

A. Wasserman, Senior Administrative Staff

PUBLICATIONS

N. De Mas, A. Guenther, T. Kraus, M.A. Schmidt, K.F. Jensen, "A microfabricated scaled-out multilayer gas-liquid microreactor with integrated velocimetry sensors," *Ind. Eng. Chem. Res.*, vol. 44, no. 24, pp. 8997-9013, Nov. 2005.

B.K.H. Yen, A. Günther, M.A. Schmidt, K.F. Jensen, and M.G. Bawendi, "A microfabricated gas-liquid segmented flow reactor for high temperature synthesis: The case of CdSe quantum dots," *Angewandte Chemie International Edition*, vol. 44, no. 34, pp. 5447-5451, June 2005.

V. Leblanc, S.-H. Kang, J. Chen, P.J. Benning, M.A. Baldo, V. Bulovic, and M.A. Schmidt, "Micromachined printhead for the patterning of organic materials and metals," in *Digest of Technical Papers. TRANSDUCERS '05. The 13th International Conference on Solid-State Sensors, Actuators and Microsystems*, vol. 2, pp. 1429 – 1432, June 2005.

T.M. Floyd, M.A. Schmidt, and K.F. Jensen, "A silicon micromixer with infrared detection for studies of liquid phase reactions," *Industrial & Engineering Chemistry Research*, vol. 44, no. 8, pp. 2351-2358, Apr. 2005.

J. Chen, V. Leblanc, S.H. Kang, M.A. Baldo, P.J. Benning, M.A. Schmidt, and V. Bulovic, "Direct patterning of molecular organic materials and metals using a micromachined printhead," in *Proc. of the Materials Research Society Spring Meeting*, San Francisco, CA, Mar./Apr. 2005.

L.G. Frechette, S.A. Jacobson, K.S. Breuer, F.F. Ehrich, R. Ghodssi, R. Khanna, C.W. Wong, X. Zhang, M.A. Schmidt, and A.H. Epstein, "High-speed microfabricated silicon turbomachinery and fluid film bearings," *IEEE/ASME Journal of Microelectromechanical Systems*, vol. 14, no.1, pp. 141-152, Feb. 2005.

A. Guenther, M. Jhunjunwala, M. Thalmann, M.A. Schmidt, and K.F. Jensen, "Micromixing of miscible liquids in segmented gas-liquid flow" *Langmuir*, vol. 21, no.4, pp. 1547-1555, Jan. 2005.

H. Lu, M.A. Schmidt, and K.F. Jensen, "A microfluidic electroporation device for cell lysis," *Lab on a Chip*, vol. 5, no.1, pp. 23-29, Jan. 2005.

J.G. Kralj, M.A. Schmidt, and K.F. Jensen, "Sufactant-enhanced liquid-liquid extraction in microfluidic channels with inline electric-field enhanced coalescence," *Lab on a Chip*, vol. 5, pp. 531-535, Apr. 2005.

C. Tsau, S.M. Spearing, and M.A. Schmidt, "Characterization of wafer-level thermocompression bonds," *IEEE/ASME Journal of Microelectromechanical Systems*, vol. 13, no.6, pp. 963-971, Dec. 2004.

S.A. Khan, A. Gunther, F. Trachsel, M.A. Schmidt, and K.F. Jensen, "Microfluidics for colloids processing," in *Proc. 8th International Symposium on Micro Total Analysis Systems*, Malmö, Sweden, Sept. 2004, pp. 411-413.

C.D. Baertsch, K.F. Jensen, J.L. Hertz, H.L. Tuller, V.T.S. Vengallatore, S.M. Spearing, and M.A. Schmidt, "Fabrication and structural characterization of self-supporting electrolyte membranes for a micro solid-oxide fuel cell," *Journal of Materials Research*, vol. 19, no. 9, pp. 2604-2615, Sept. 2004.

X. Yang, A. Hölke, S.A. Jacobson, J.H. Lang, M.A. Schmidt, and S.D. Umans, "An electrostatic, on/off MEMS valve designed for gas fuel control for the MIT microengine," *IEEE/ASME Journal of Microelectromechanical Systems*, vol. 13, no.4, pp. 660-668, Aug. 2004.

Alexander Slocum

Professor

Department of Mechanical Engineering

COLLABORATORS

J. Lang, MIT

GRADUATE STUDENTS

A.J. Hart, ME

S. Hou, EECS

H. Ma, EECS

A. Weber, ME

O. Yaglioglu, ME

SUPPORT STAFF

M. Lynch, Admin. Asst. II

PUBLICATIONS

M. Sweetland, J.H. Lienhard, A.H. Slocum, "A convection/radiation temperature control system for high power density electronic device testing," *IEEE Transactions on Applied Electronic Packaging*, to be published.

M. Akilian, C.R. Forest, A.H. Slocum, D.L. Trumper, D.L., and M.L. Schattenburg, "Thin optic constraint," *Precision Engineering*, to be published.

A.J. Hart and A.H. Slocum, "Force output, control of film structure, and micro-scale shape transfer by carbon nanotube growth under mechanical pressure," *NanoLetters*, vol. 6, no. 6, pp. 1254-1260, May 2006.

A.J. Hart, B. O. Boskovic, A. T. H. Chuang, V. B. Golovko, J. Robertson, B. F. G. Johnson, and A. H. Slocum, "Uniform and selective CVD growth of carbon nanotubes and nanofibres on arbitrarily microstructured silicon surfaces," *Nanotechnology*, vol. 17, no. 5, pp. 1397-1403, Mar. 2006.

A.J. Hart and A.H. Slocum, "Rapid growth and flow-mediated nucleation of millimeter-scale aligned carbon nanotube structures from a thin-film catalyst," *Journal of Physical Chemistry B*, vol. 110, no. 16, pp. 8250-8257, Mar. 2006.

A.J. Hart, A.H. Slocum, L. Royer," Growth of high-quality single-walled carbon nanotube films from Mo/Fe/Al₂O₃ deposited by electron beam evaporation," *Carbon*, vol. 44, no. 2, pp. 348-359, Feb. 2006.

H. Ma and A.H. Slocum, "A flexible-input, desired-output motor controller for engineering design classes," *IEEE Transactions on Education*, vol. 49, no. 1, pp. 113-121, Feb. 2006.

E. Bamberg, C.P. Grippo, P. Wanakamol, A.H. Slocum, M.C. Boyce, E.L. Thomas, "A tensile test device for *in situ* atomic force microscope mechanical testing," *Precision Engineering*, vol. 30, no. 1, pp. 71-84, Jan. 2006.

J. Li, M.P. Brenner, T. Christen, M.S. Kotilainen, J.H. Lang, and A.H. Slocum, "Deep reactive ion-etched compliant starting zone electrostatic zipping actuators," *Journal Of Microelectromechanical Systems*, vol. 14, no. 6, pp. 1283-1297, Dec. 2005.

J.R. White, C.J. White, A.H. Slocum, "Octave-tunable miniature rf resonators," *IEEE Microwave and Wireless Components Letters*, vol. 15, no. 11, pp. 793-795, Nov. 2005.

J. Qiu, J. Lang, A.H. Slocum, and A. Weber, "A bulk-micromachined bistable relay with u-shaped thermal actuators," *Journal Of Microelectromechanical Systems*, vol. 14, no. 5, pp. 1099-1109, Oct. 2005.

Henry I. Smith

Professor

Department of Electrical Engineering and Computer Science

COLLABORATORS

J.T. Hastings, Univ. Kentucky
C.A. Ross, MIT
C.V. Thompson, MIT
F.R. Stellacci, MIT
E. Ippen, MIT
F. Kaertner, MIT
M. Schattenburg, MIT

GRADUATE STUDENTS

A. Patel, Res. Asst., EECS
C. Holzwarth, Res. Asst., MSE
T. B. O'Reilly, Res. Asst., ME
W. Aroro, Res. Asst., EECS
R. Barreto, Res. Asst., EECS
S. Tsai, Res. Asst., EECS

SUPPORT STAFF

T. Kuhn, Admin. Asst.

PUBLICATIONS

P.T. Rakich, M.A. Popovic, M.R. Watts, T. Barwicz, H.I. Smith and E.P. Ippen, "Ultra-wide tuning of photonic microcavities via evanescent field perturbation," *Optics Letters*, to be published.

M.D. Galus, E.E. Moon, H.I. Smith, and R. Menon, "Replication of diffractive-optical arrays via step-and-flash nano-imprint lithography," *Journal of Vacuum Science and Technology*, to be published.

E.E. Moon, P.N. Everett, and H.I. Smith, "Nanometer-precision pattern registration for scanning-probe lithographies using interferometric-spatial-phase imaging," *Journal of Vacuum Science and Technology*, to be published.

H.I. Smith, R. Menon, A. Patel, D. Chao, M. Walsh, and G. Barbastathis, "Zone-plate-array lithography: A low-cost complement or competitor to scanning-electron-beam lithography," *Microelectronic Engineering*, 2006, to be published.

T. Barwicz, M.A. Popovic, M.R. Watts, P.T. Rakich, E.P. Ippen and H.I. Smith, "Fabrication of add-drop filters based on frequency-matched microring-resonators," *Journal of Lightwave Technology*, May 2006, to be published.

R. Menon, D. Gil, and H.I. Smith "Experimental characterization of focusing by high-numerical-aperture zone plates," *Journal of the Optical Society of America*, vol. 23, no. 3, pp. 567-571, Mar. 2006.

G. Onoa, T.B. O'Reilly, M.E. Walsh, and H.I. Smith, "Bulk production of singly dispersed carbon nanotubes with prescribed lengths," *Nanotechnology*, vol. 16, no. 12, pp. 2799-2803, Dec. 2005.

R.Z. Lei, W. Tsai, I. Aberg, T.B. O'Reilly, J.L. Hoyt, D.A. Antoniadis, H.I. Smith, A.J. Paul, M.L. Green, J. Li, and R. Hull, "Strain relaxation in patterned strained silicon directly on insulator structures," *Applied Physics Letters*, vol. 87, no. 25, pp. 251926, Dec. 2005.

Q. Leonard, D. Malueg, J. Wallace, J.W. Taylor, S. Dhuey, F. Cerrina, B. Boerger, R. Selzer, M. Yu, Y. Ma, K. Meyers, M. Trybendis, E.E. Moon, and H.I. Smith, "Development, installation, and performance of the x-ray stepper JSAL 5C," *Journal of Vacuum Science and Technology B*, vol. 23, no. 5, pp. 2896, Nov. 2005.

E.E. Moon, M.K. Mondol, P.N. Everett, and H.I. Smith, "Dynamic alignment control for fluid-immersion lithographies using interferometric-spatial-phase imaging," *Journal of Vacuum Science and Technology B*, vol. 23, no. 6, pp. 2607, Nov. 2005.

F. Zhang, H.I. Smith, and J. Dai, "Fabrication of high-secondary-electron-yield grids for spatial-phase-locked electron-beam lithography," *Journal of Vacuum Science and Technology B*, vol. 23, no. 6, pp. 3061-3064, Nov. 2005.

D. Chao, A. Patel, T. Barwicz, H.I. Smith, and R. Menon, "Immersion zone-plate-array lithography," *Journal of Vacuum Science and Technology B*, vol. 23, no. 5, pp. 2657-2661, Nov. 2005.

W. Jung, F.J. Castaño, D. Morecroft, C.A. Ross, R. Menon, and H.I. Smith, "Magnetization reversal in single-layer and exchange biased elliptical ring arrays," *Journal of Applied Physics*, vol. 97, no. 10, pp. 10K113, Oct. 2005.

A.A. Yu, T.A. Savas, G. Scott Taylor, A. Guiseppe-Elie, H.I. Smith, and F. Stellacci, "Supramolecular nanostamping: Using DNA as moveable type," *Nano Letters*, vol. 5, no. 6, pp. 1061-1064, June 2005.

R. Menon, D. Gil, G. Barbastathis, and H.I. Smith, "Photon-sieve lithography," *Journal of the Optical Society of America*, vol. 22, no. 2, pp. 342-345, Feb. 2005.

R. Menon, A. Patel, D. Gil, and H.I. Smith, "Maskless lithography," *Materials Today*, vol. 8, no. 2, pp. 26-33, Feb. 2005.

C.A. Ross, F.J. Castaño, E. Rodriguez, S. Haratani, B. Vogeli and H.I. Smith, "Size-dependent switching of multilayer magnetic elements," *Journal of Applied Physics*, vol. 97, no. 2, pp. 281-286, Feb. 2005.

Charles G. Sodini

Professor

Department of Electrical Engineering and Computer Science

COLLABORATORS

P. Holloway, National Semiconductor

GRADUATE STUDENTS

F. Edalat, National Defense Science and Engineering Fellow, EECS

J. Fiorenza, Res. Asst., EECS

A. Jerng, Res. Asst., EECS

L. Khuon, Res. Asst., EECS

K. Lamba, Res. Asst., EECS

A. Lin, Res. Asst., EECS

I. Nausieda, Res. Asst., EECS

K. Nguyen, Res. Asst., EECS

A. Pham, Res. Asst., EECS

J. Powell, National Science Foundation Fellow, Lincoln Lab

K. Ryu, Res. Asst., EECS

T. Sepke, Res. Asst., EECS

K. Tan, Res. Asst., EECS

A. Wang, Res. Asst., EECS

SUPPORT STAFF

R. Maynard, Admin. Asst. II

PUBLICATIONS

L. Khuon and C.G. Sodini, "An area-efficient 5-GHz multiple receiver RFIC for MIMO WLAN applications," to be presented at the *IEEE Radio Frequency Integrated Circuits Symposium*, San Francisco, CA, June 2006.

A. Pham and C.G. Sodini, "A 5.8 GHz, 47% efficiency, linear outphase power amplifier with fully integrated power combiner," to be presented at the *IEEE Radio Frequency Integrated Circuits Symposium*, San Francisco, CA, June 2006.

A. Wang and C.G. Sodini, "On the energy efficiency of wireless transceivers," to be presented at the *IEEE International Conference on Communications*, Istanbul, Turkey, June 2006.

A. Pham, G.W. Wornell, and C.G. Sodini, "A digital amplitude-to-phase conversion for high efficiency linear outphase power amplifiers," presented at the *IEEE International Conference on Acoustics, Speech, and Signal Processing*, 2006.

T. Sepke, J.K. Fiorenza, C.G. Sodini, P. Holloway, and H.-S. Lee, "Comparator based switched capacitor circuits for scaled CMOS technologies," in *Proc. IEEE International Solid-State Circuits Conference*, San Francisco, CA, Feb. 2006, pp. 220-221, 649.

D.B. Fuller, A.I. Akintunde, and C.G. Sodini, "Leading, Following, or Cooked Goose? Explaining Innovations, Successes and Failures in Taiwan's Electronics Industry," in *Global Taiwan: Building Competitive Strengths in a New International Economy*, ed. Suzanne Berger and Richard Lester, Armonk: M.E. Sharpe, 2005, pp. 76-96.

K. Ryu, I. Kymissis, V. Bulovic, and C.G. Sodini, "Direct extraction of mobility in pentacene OFETs using capacitance-voltage and current-voltage measurements," *IEEE Electron Devices Letters*, vol. 26, no. 10, pp. 716-718, Oct. 2005.

L. Khuon, E.W. Huang, C.G. Sodini, and G.W. Wornell, "Integrated transceiver arrays for multiple antenna systems," presented at *IEEE 61st Semiannual Vehicular Technology Conference*, 2005.

A. Jerng and C.G. Sodini, "The impact of device type and sizing on phase noise mechanisms," *IEEE Journal of Solid-State Circuits*, vol. 40, no. 2, pp. 360-369, Feb. 2005.

A.Y. Wang and Sodini, C.G., "A simple energy model for wireless microsensor transceivers," in *Proc. IEEE Global Telecommunications Conference*, Dallas, TX, Dec. 2004, pp. 3205-3209.

R.T. Howe and C.G. Sodini, *Microelectronics: An Integrated Approach*. Upper Saddle River: Prentice Hall, 1997.

R. Reif and C.G. Sodini, "Hong Kong Electronics Industry," in *Made in Hong Kong*, ed. Suzanne Berger and Richard Lester, New York: Oxford University Press, 1997, pp. 186-215.

Vladimir Stojanovic

Assistant Professor

Department of Electrical Engineering and Computer Science

COLLABORATORS

A. Amirkhany, Stanford University
M. Horowitz, Stanford University
S. Vamvakos, UC Berkeley
B. Nikolic, UC Berkeley

GRADUATE STUDENTS

N. Blitvic, Res. Asst., EECS
F. Chen, Res. Asst., EECS
B. Kim, Res. Asst., EECS
M. Lee, Res. Asst., EECS
S. Song, Res. Asst., EECS
R. Sredojevic, Res. Asst., EECS

PUBLICATIONS

B. Garlepp, A. Ho, V. Stojanovic, F. Chen, C. Werner, G. Tsang, T. Thrush, A. Agarwal and J. Zerbe, "A 1-10 Gbps PAM2, PAM4, PAM2 partial response receiver analog front end with dynamic sampler swapping capability for backplane serial communications," presented at the *IEEE Symposium on VLSI Circuits*, 2005.

C. Werner, C. Hoyer, A. Ho, M. Jeeradit, F. Chen, B. Garlepp, W. Stonecypher, S. Li, A. Bansal, A. Agarwal, E. Alon, V. Stojanovic and J. Zerbe, "Modeling, simulation, and design of a multi-mode 2-10 Gb/sec fully adaptive serial link system," presented at the *IEEE Custom Integrated Circuits Conference*, 2005.

E. Alon, V. Stojanovic and M.A. Horowitz, "Circuits and techniques for high-resolution measurement of on-chip power supply noise," *IEEE Journal of Solid-State Circuits*, vol. 40, no. 4, pp. 820-828, 2005.

V. Stojanovic, A. Ho, B. Garlepp, F. Chen, J. Wei, G. Tsang, E. Alon, R. Kollipara, C. Werner, J. Zerbe, and M. Horowitz, "Autonomous dual-mode (PAM2/4) serial link transceiver with adaptive equalization and data recovery," *IEEE Journal of Solid-State Circuits*, vol. 40, no. 4, pp. 1012-1026, Apr. 2005.

E. Alon, V. Stojanovic, J. M. Kahn, S. Boyd, and M. Horowitz, "Equalization of modal dispersion in multimode fiber using spatial light modulators," presented at the *IEEE Global Communications Conference*, 2004.

A. Amirkhany, V. Stojanovic, and M. Horowitz, "Multi-tone signaling for high-speed backplane electrical links," presented at the *IEEE Global Communications Conference*, 2004.

D. Markovic, V. Stojanovic, B. Nikolic, M.A. Horowitz, and R.W. Brodersen, "Methods for true energy-performance optimization," *IEEE Journal of Solid-State Circuits*, vol. 39, no. 8, pp. 1282-1293, Aug. 2004.

V. Stojanovic, A. Ho, B. Garlepp, F. Chen, J. Wei, E. Alon, C. Werner, J. Zerbe, and M.A. Horowitz, "Adaptive equalization and data recovery in dual-mode (PAM2/4) serial link transceiver," presented at the *IEEE Symposium on VLSI Circuits*, 2004.

A. Ho, V. Stojanovic, F. Chen, C. Werner, G. Tsang, E. Alon, R. Kollipara, J. Zerbe, and M.A. Horowitz, "Common-mode backchannel signaling system for differential high-speed links," presented at the *IEEE Symposium on VLSI Circuits*, 2004.

E. Alon, V. Stojanovic, and M.A. Horowitz, "Circuits and techniques for high-resolution measurement of on-chip power supply noise," presented at the *IEEE Symposium on VLSI Circuits*, 2004.

V. Stojanovic, A. Amirkhany, and M. Horowitz, "Optimal linear precoding with theoretical and practical data rates in high-speed serial-link backplane communication," presented at the *IEEE International Conference on Communications*, 2004.

J. Zerbe, C. Werner, V. Stojanovic, F. Chen, J. Wei, G. Tsang, D. Kim, W. Stonecypher, A. Ho, T. Thrush, R. Kollipara, M. Horowitz, and K. Donnelly, "Equalization and clock recovery for a 2.5 - 10Gb/s 2-PAM/4-PAM backplane transceiver cell," *IEEE Journal of Solid-State Circuits*, vol. 38, no. 12, pp. 2121-2130, Dec. 2003.

V. Stojanovic and M. Horowitz, "Modeling and analysis of high-speed links," presented at the *IEEE Custom Integrated Circuits Conference*, 2003.

J. Zerbe, C. Werner, V. Stojanovic, F. Chen, J. Wei, G. Tsang, D. Kim, W. Stonecypher, A. Ho, T. Thrush, R. Kollipara, M. Horowitz, and K. Donnelly, "Equalization and clock recovery for a 2.5 - 10Gb/s 2-PAM/4-PAM backplane transceiver cell," presented at the *IEEE International Solid-State Circuits Conference*, 2003.

R.W. Brodersen, M.A. Horowitz, D. Markovic, B. Nikolic, and V. Stojanovic, "Methods for true power minimization," in *Proc. International Conference on Computer Aided Design*, San Jose, CA, Nov. 2002, pp. 35-42.

V. Stojanovic, D. Markovic, B. Nikolic, M.A. Horowitz, and R.W. Brodersen, "Energy-delay tradeoffs in combinational logic using gate sizing and supply voltage optimization," presented at the *European Solid-State Circuits Conference*, 2002.

V. Stojanovic, G. Ginis, M.A. Horowitz, "Transmit pre-emphasis for high-speed time-division-multiplexed serial-link transceiver," presented at the *IEEE International Conference on Communications*, 2002.

Carl V. Thompson

Stavros Salapatas Professor of Materials Science and Engineering
Department of Materials Science and Engineering

COLLABORATORS

D.A. Antoniadis, MIT
M. Burns, Rowland Institute at Harvard University
W.K. Choi, National University of Singapore
S.J. Chua, National University of Singapore
C. Hau-Riege, Advanced Micro Devices
C.L. Gan, Nanyang Technical University
E.A. Fitzgerald, MIT
O. Nayfeh, MIT
K.L. Pey, National University of Singapore
C.A. Ross, MIT
H.I. Smith, MIT
K. Turner, U. of Wisconsin
D.E. Troxel, MIT

POSTDOCTORAL FELLOW

R. Moenig

GRADUATE STUDENTS

S. Boles, Res. Asst., MSE
S.-W. Chang, Res. Asst., MSE
Z. Choi, Res. Asst., MSE
A. Geirmann, Intel Fellow, MSE
J. Leib, NSF Fellow, MSE
H.L. Leong, SMA Fellow, SMA
G. Nessim, Res. Asst., MSE
J. Oh, Res. Asst., MSE
G. Qiang, SMA Fellow, SMA
A. R. Takahashi, Res. Asst., MSE
R. Tadepalli, Res. Asst., MSE
F. Wei, Res. Asst., MSE
J. Ye, Res. Asst., MSE

SUPPORT STAFF

C. Mallet, Admin. Asst. II

PUBLICATIONS

K.Y. Zang, Y.D. Wang, S.J. Chua, L.S. Wang, S. Tripathy and C.V. Thompson, "Nanoheteroepitaxial lateral overgrowth of GaN on nanoporous Si (111)," *Applied Physics Letters*, to be published.

A.L. Geirmann and C.V. Thompson, "Solid state dewetting for ordered arrays of crystallographically oriented metal particles," *Applied Physics Letters*, vol. 86, pp. 121903:1-3, Mar. 2005.

S.M. Alam, C.L. Gan, F.L. Wei, C.V. Thompson, and D.E. Troxel, "Circuit-level reliability requirements for Cu metallization," *IEEE Transactions on Device and Materials Reliability*, vol. 5, no. 3, pp. 522-531, Sept. 2005.

R. Krishnan, H.Q. Nguyen, Carl V. Thompson, W.K. Choi, and Y.L. Foo, "Wafer-level ordered arrays of carbon nanotubes with controlled size and spacing on silicon," *Nanotechnology*, vol. 16, no. 6, pp. 841-846, June 2005.

T. Trimble, L. Tang, N. Vasiljevic, N. Dimitrov, M. van Schilfgaarde, C. Friesen, C.V. Thompson, S.C. Seel, J.A. Floro, and K. Sieradzki, "Anion adsorption induced reversal of coherency strain," *Physical Review Letters*, vol. 95, pp. 166106, Oct. 2005.

H.Q. Le, S.J. Chua, Y.W. Koh, K.P. Loh, Z. Chen Z, C.V. Thompson, and E.A. Fitzgerald, "Growth of single crystal ZnO nanorods on GaN using an aqueous solution method," *Applied Physics Letters*, vol. 87, pp. 101908:1-3, Sept. 2005.

K.Y. Zang, L.S. Wang, S.J. Chua, and C.V. Thompson, "Structural analysis of metalorganic chemical vapor deposited AlN nucleation layers on Si(111)," *Journal of Crystal Growth*, vol. 268, no. 3-4, pp. 515-520, Aug. 2004.

C. Friesen and C.V. Thompson, "Comment on compressive stress in polycrystalline Volmer-Weber films," *Physical Review Letters*, vol. 95, pp. 229601, Nov. 2005.

Z.-S. Choi, C.W. Chang, J.H. Lee, C.L. Gan, C.V. Thompson, K.L. Pey and W.K. Choi, "Multi-via electromigration test structures for identification and characterization of different failure mechanisms," in *Proc. Materials, Technology and Reliability of Advanced Interconnects*, San Francisco, CA, Apr. 2005, pp. B9.4.1-B9.4.6.

S.M. Alam, D.E. Troxel, and C.V. Thompson, "Thermal aware cell-based methodology for full-chip electromigration reliability analysis," in *Proc. 15th ACM Great Lakes Symposium on VLSI*, Chicago, IL, Apr. 2005, p. 26.

S.M. Alam, F.L. Wei, C.L. Gan, C.V. Thompson, and D.E. Troxel, "Electromigration Reliability comparison of Al and Cu interconnect technologies," in *Proc. Sixth International Symposium on Quality Electronic Design*, San Jose, CA, Mar. 2005, p. 303-308.

C.V. Thompson, "Nanomaterials in integrated circuits," in *Proc. of the Symposium on Future Integrated Systems*, Cambridge, United Kingdom, Aug. 2005, p.52.

C.V. Thompson, "Effects of mechanical properties on the circuit-level reliability of Cu/low-k metallization," in *Proc. 8th International Workshop on Stress-Induced Phenomena in Metallization*, Dresden, Germany, Sept. 2005, pp. 231-243.

Todd Thorsen

Assistant Professor

Department of Mechanical Engineering

COLLABORATORS

D. Luo, Cornell
R. Gilbert, MIT
L.D. Samson, MIT
S. Amarasinghe, MIT

GRADUATE STUDENTS

J.P. Urbanski, Res. Asst., ME
H. Park, Res. Asst., ME
M. Kumar, Res. Asst., ME
R. Lam, Res. Asst., ME

SUPPORT STAFF

S. Buhrmester, Admin. Asst.

PUBLICATIONS

J.A. Benn, J. Hu, B.J. Hogan, R.C. Fry, L.D. Samson, and T. Thorsen, "Comparative modeling and analysis of microfluidic and conventional DNA microarrays," *Analytical Biochemistry*, vol. 348, no. 2, pp. 284-293, Jan. 2006.

J.P. Urbanski, W. Thies, C. Rhodes, S. Amarasinghe, and T. Thorsen, "Digital microfluidics using soft lithography," in *Lab on a Chip*, vol. 6, no. 1, pp. 96-104, Nov. 2005.

B.G. De Geest, J.P. Urbanski, T. Thorsen, S.C. De Smedt, and J. Demeester, "Synthesis of biodegradable microgels in microfluidic devices," *Langmuir*, vol. 21, no. 23, pp. 10275-10279, Sept. 2005.

A.P. Vollmer, R.F. Probst, R. Gilbert, and T. Thorsen, "Development of an integrated microfluidic platform for dynamic oxygen sensing and delivery in a flowing medium," *Lab on a Chip*, vol. 5, pp. 1059-1066, Aug. 2005.

J.A. Levitan, S. Devasenathipathy, V. Studer, Y. Ben, T. Thorsen, T.M. Squires, and M.Z. Bazant, "Experimental observation of induced-charge electro-osmosis around a metal wire in a microchannel," in *Proc. of International Conference on Electrokinetics*, Pittsburgh, PA, June 2004, pp. 122-132.

T. Thorsen, "Microfluidic tools for high-throughput screening," *Biotechniques*, vol. 36, no. 2, pp. 177-179, Feb. 2004.

G.-R. Yi, S.-J. Jeon, T. Thorsen, V.N. Manoharan, D.J. Pine, S.R. Quake, and S.-M. Yang, "Generation of uniform photonic balls by template-assisted colloidal crystallization," *Synthetic Metals*, vol. 139, no. 3, pp. 803-806, Oct. 2003.

G.-R. Yi, T. Thorsen, V.N. Manoharan, M.-J. Hwang, D.J. Pine, S.R. Quake, and S.-M. Yang, "Generation of uniform colloidal assemblies in soft-microfluidic devices," *Advanced Materials*, vol. 15, no. 15, pp. 1300-1304, Aug. 2003.

T. Thorsen, S.J. Maerkl, and S.R. Quake, "Microfluidic large scale integration," *Science*, vol. 298, no. 5593, pp. 580-584, Oct. 2002.

T. Thorsen, R.W. Roberts, F.H. Arnold, and S.R. Quake, "Dynamic pattern formation in a vesicle-generating microfluidic device," *Physical Review Letters*, vol. 86, no. 18, pp. 4163-4166, Apr. 2001.

M.A. Unger, H.-P. Chou, T. Thorsen, A. Scherer, and S.R. Quake, "Monolithic microfabricated valves and pumps by multilayer soft lithography," *Science*, vol. 288, no. 5463, pp. 113-116, Apr. 2000.

P.C. Simpson, D. Roach, A.T. Woolley, T. Thorsen, R. Johnston, G.F. Sensabaugh, and R.A. Mathies, "High-throughput genetic analysis using microfabricated 96-sample capillary array electrophoresis microplates," in *Proc. Natl. Acad. Sci.*, vol. 95, no. 5, pp. 2256-2261, Mar. 1998.

L. Calandro, T. Thorsen, L. Barcellos, J. Griggs, D. Baer, and G.F. Sensabaugh, "Mutation analysis in hereditary hemo-chromatosis (Commentary)," *Blood Cells, Molecules and Diseases*, vol. 22, no. 16, 194a-194b, Aug. 1996.

Joel Voldman

NBX Associate Professor

Department of Electrical Engineering and Computer Science

COLLABORATORS

G. Daley, Children's Hospital
K.M. Lim, NUS, Singapore
G. Stephanopoulos, MIT
F. McKeon, Harvard Med. School
G. Vunjak-Novacovic, Columbia
J. White, MIT

GRADUATE STUDENTS

S. Desai, Research Asst., EECS
H.-Y. Lee, Research. Asst., EECS
L.Y. Kim, Research Asst., HST
J.R. Kovac, Research Asst., EECS
N. Mittal, Research Asst., Physics
K. Puchala, Research Asst., EECS
A.D. Rosenthal, Res. Asst., HST
P. Sampattavanich, Res. Asst., EECS
N. Tandon, Research Asst., EECS
B. Taff, Res. Asst., EECS
M. Vahey, Research Asst., EECS

SUPPORT STAFF

S. Chafe, Admin. Asst.

PUBLICATIONS

- J. Voldman, "Electrical forces for microscale cell manipulation," *Annual Review of Biomedical Engineering*, Aug. 2006, to be published.
- J. Voldman, "Dielectrophoretic traps for cell manipulation," in *BioMEMS and Biomedical Nanotechnology*, A.P. Lee, J. Lee, and M. Ferrari, Eds. New York, NY: Springer, 2006.
- A. Rosenthal, B.M. Taff, and M.D. Vahey, "Quantitative modeling of dielectrophoretic traps," *Lab Chip*, vol. 6, no. 4, pp. 508-515, Apr. 2006.
- L. Kim, M.D. Vahey, H.-Y. Lee, and J. Voldman, "Microfluidic arrays for logarithmically perfused embryonic stem cell culture," *Lab Chip*, vol. 6, no. 3, pp. 394-406, Mar. 2006.
- B.M. Taff and J. Voldman, "A scalable row/column-addressable dielectrophoretic cell-trapping array," in *Proc. Ninth International Conference on Miniaturized Systems for Chemistry and Life Sciences (μ TAS)*, Boston, MA, Oct. 2005, pp. 865-867.
- L.Y. Kim, H.-Y. Lee, and J. Voldman, "Logarithmically perfused embryonic stem cell culture on chip," in *Proc. Ninth International Conference on Miniaturized Systems for Chemistry and Life Sciences (μ TAS)*, Boston, MA, Oct. 2005, pp. 530-532.
- A.D. Rosenthal and J. Voldman, "Dielectrophoretic traps for single-particle patterning," *Biophysical Journal*, vol. 88, no. 3, pp. 2193-2205, Mar. 2005.
- A.D. Rosenthal and J. Voldman, "Simple, strong, and size-selective dielectrophoretic trap for single-cell patterning," in *Proc. Eighth International Conference on Miniaturized Systems for Chemistry and Life Sciences (μ TAS)*, Malmö, Sweden, Sept. 2004, pp. 228-230.
- D.S. Gray, J.L. Tan, J. Voldman, and C.S. Chen, "Dielectrophoretic registration of living cells to a microelectrode array," *Biosensors and Bioelectronics*, vol. 19, no. 12, pp. 1765-1774, July 2004.
- J. Voldman, "BioMEMS - Building with cells," *Nature Materials*, vol. 2, no. 7, pp. 433-434, July 2003.
- J. Voldman, M. Toner, M.L. Gray, and M.A. Schmidt, "Design and analysis of extruded quadrupolar dielectrophoretic traps," *Journal of Electrostatics*, vol. 57, no. 1, pp. 69-90, Jan. 2003.
- J. Voldman, M. Toner, M.L. Gray, and M.A. Schmidt, "A microfabrication-based dynamic array cytometer," *Analytical Chemistry*, vol. 74, no. 16, pp. 3984-3990, Aug. 2002.
- J. Voldman, M. Toner, M.L. Gray, and M.A. Schmidt, "A dielectrophoresis-based array cytometer," in *Proc. Transducers 2001: 11th International Conference on Solid-State Sensors & Eurosensors XV*, Munich, Germany, June 2001, pp. 322-325.
- J. Voldman, R.A. Braff, M. Toner, M.L. Gray, and M.A. Schmidt, "Holding forces of single-particle dielectrophoretic traps," *Biophysical Journal*, vol. 80, no. 1, pp. 531-541, Jan. 2001.
- J. Voldman, M.L. Gray, and M.A. Schmidt, "An integrated liquid mixer/valve," *Journal of Microelectromechanical Systems*, vol. 9, no. 3, pp. 295-302, Sept. 2000.
- J. Voldman, R.A. Braff, M. Toner, M.L. Gray, and M.A. Schmidt, "Quantitative design and analysis of single-particle dielectrophoretic traps," in *Proc. International Conference on Miniaturized Systems for Chemistry and Life Sciences (μ TAS)*, Twente, The Netherlands, May 2000, pp. 431-434.
- J. Voldman, M.L. Gray, and M.A. Schmidt, "Microfabrication in biology and medicine," *Annual Review of Biomedical Engineering*, vol. 1, pp. 401-425, Aug. 1999.
- J. Voldman, M.L. Gray, and M.A. Schmidt, "Liquid mixing studies using an integrated mixer/valve," in *Proc. International Conference on Miniaturized Systems for Chemistry and Life Sciences (μ TAS)*, Banff, Canada, Oct. 1998, pp. 181-184.

Brian L. Wardle

Boeing Assistant Professor
Department of Aeronautics and Astronautics

COLLABORATORS

K.F. Jensen, MIT
S. Kessler, Metis Design Corp.
W.-S. Kim, MIT
S.-G. Kim, MIT
D. Pafitis, Schlumberger-Doll Research Center
M. A. Schmidt, MIT
D.-J. Shim, MIT
A. H. Slocum, MIT
S.M. Spearing, Univ. Southampton
H. Tuller, MIT
N. Wicks, MIT
C.-Y. Wu, China Steel

GRADUATE STUDENTS

P. Capozzoli, Res. Asst., AA/Sloan
J. Chambers, Res. Asst., AA
N. duToit, Res. Asst., AA
E. Garcia, La Caixa Fellow, AA
A. Mracek, Res. Asst., AA
D. Quinn, NSF Fellow, ME
N. Yamamoto, Res. Asst., AA

UNDERGRADUATE STUDENTS

K. Sorensen, AA
S. Tonn, AA
S. Wicks
H. Wong, AA

SUPPORT STAFF

J. Kane, Research Specialist
P. Lee, Financial Officer
M. Prendergast, Admin. Assist. II

PUBLICATIONS

N.E. duToit, B.L. Wardle, and S.-G. Kim, "Design considerations for MEMS-scale piezoelectric vibration energy harvesters," *Integrated Ferroelectric*, vol. 71, pp. 121-160, 2005.

E.J. Garcia, J. Hart,, B.L. Wardle, and A. Slocum, "Composite materials reinforced with long CNTS grown on the surface of fibers," in *Proc. 47th AIAA Structures, Dynamics, and Materials Conference*, Newport, RI, May 2006, doc. 1854.

N.E. duToit and B. L. Wardle, "Experimental verification of models for microfabricated piezoelectric vibration energy harvesters," in *Proc. 47th AIAA Structures, Dynamics, and Materials Conference*, Newport, RI, May 2006, doc. 1792.

J.T. Chambers, B.L. Wardle, and S.S. Kessler, "Durability assessment of Lamb wave-based structural health monitoring nodes," in *Proc. 47th AIAA Structures, Dynamics, and Materials Conference*, Newport, RI, May 2006, doc. 2263.

B.L. Wardle, "The incorrect benchmark shell buckling solution," in *Proc. 47th AIAA Structures, Dynamics, and Materials Conference*, Newport, RI, May 2006, doc. 2028.

S.S. Kessler, K. Amaratunga, and B.L. Wardle, "An assessment of durability requirements for aircraft structural health monitoring sensors," in *Proc. 5th International Workshop on Structural Health Monitoring*, Stanford, CA, Sept. 2005, p. 9.

N. Yamamoto, N. Wicks, and B.L. Wardle, "Wrapping and through-thickness poisson effects on composite plates and shell contact laws," presented at the *46th AIAA Structures, Dynamics, and Materials Conference*, 2005.

N. Wicks, B.L. Wardle, and D. Pafitis, "Horizontal cylinder-in-cylinder buckling under compression and torsion: review and considerations for oil drilling applications," presented at the *15th International Conference on Composite Materials (ICCM)*, 2005.

D. Quinn, S.M. Spearing, and B. L. Wardle, "Residual stress and microstructural evolution in thin film materials for a micro solid oxide fuel cell (SOFC)," presented at the *Materials Research Society (MRS) Annual Fall Conference*, 2004.

