Joseph C. Doll

Education

Ph.D. Mechanical Engineering, Stanford University (2012)

Dissertation: Advances in high bandwidth nanomechanical force sensors with integrated actuation
Advisor: Beth Pruitt

M.S. Mechanical Engineering, Stanford University (2009)

B.S. Mechanical Engineering, University of California at Berkeley (2006)

Honors Thesis: Biocompatible Nanoplasmonic Probes for the Detection of Single Biomolecules
Research Advisor: Luke Lee

Work experience

Google (2007)

Software engineering intern in internal applications

Developed Google Grants (www.google.com/grants) with one other software engineer

ERG Aerospace (2003 - 2006)

Design engineer for metal, carbon and ceramic foams used in high-performance aerospace systems

Responsibilities included mechanical design and testing, CAD, sales, marketing, web design and IT

Professional interests

Sub-micron micromachining and process development
Integrated mechanical, electrical and thermal design
Piezoresistive and piezoelectric sensor design
Numerical design optimization
AlN film and process development
Sensor fusion and integrated systems

Process experience

Mask layout and 0.5 μm MEMS lithography and process development

RIE, DRIE and wet etch recipe development, particularly for AlN, Al, Mo, Si, SiO_2 and Ti

PVD, CVD and ALD experience including AlN, Al, Mo, PSG, parylene, SiO_2, Ti and high-k dielectrics

Experience in wafer dicing and the release of delicate structures (HF vapor and CPD)

Expertise in ion implantation, epitaxy, predeposition, interconnects and contacts

Strong background in metrology including AES, AFM, FIB, SEM, SIMS, SRA, Raman, VASE, XPS, XRD

Skills and expertise

Device design: lumped parameter modeling (thermal, electrical, mechanical), solid state physics, FEA, L-Edit

Coding: numerical analysis, optimization, Monte Carlo method, computer vision, OpenCV, HTML, CSS, SQL, git, SVN, Latex, Apache, Java, Matlab, Python, shell scripting

Electronics: analog circuit design, feedback control, integrated circuit and device physics, PCB layout

Experimental design: statistical analysis, DoE, JMP

Operating systems: Unix/Linux, OS X, Windows

Publications

Books

Piezoresistor design and applications
J.C. Doll and B.L. Pruitt
In preparation. Estimated completion and publication in 2012

Book chapters

Force sensing optimization and applications
J.C. Doll, S.-J. Park, A.J. Rastegar, N. Harjee, J.R. Mallon Jr., G. Hill, A.A. Barlian and B.L. Pruitt
Advanced Materials and Technologies for Micro/Nano-Devices, Sensors and Actuators. Springer (2010)

Selected archival journal publications (14 total, 5 first-author)

Patterned cracks improve yield in the release of compliant microdevices from silicon-on-insulator wafers
G.C. Hill, J.I. Padovani, **J.C. Doll**, B.W. Chui, D. Rugar, H.J. Mamin, N. Harjee, B.L. Pruitt
Journal of Micromechanics and Microengineering (2011)

Self-heating in piezoresistive cantilevers
J.C. Doll, E.A. Corbin, W.P. King, and B.L. Pruitt
Applied Physics Letters (2011)

Role of surface roughness in hysteresis during adhesive elastic contact
H.K. Kesari, **J.C. Doll**, B.L. Pruitt, W. Cai, A.J. Lew
Philosophical Magazine Letters (2010)
Recognized as a highly commended paper of 2010

Design of piezoresistive vs. piezoelectric contact mode scanning probes
J.C. Doll and B.L. Pruitt
Journal of Micromechanics and Microengineering (2010)
Chosen as one of the highlight papers of 2010

Aluminum nitride on titanium for CMOS compatible piezoelectric transducers
J.C. Doll, B.C. Petzold, B. Ninan, R. Mullapudi, B.L. Pruitt
Journal of Micromechanics and Microengineering (2010)

Piezoresistive cantilever performance, part II: optimization
S.-J. Park, **J.C. Doll**, A.J. Rastegar, and B.L. Pruitt
Journal of Microelectromechanical Systems (2010)

Piezoresistive cantilever performance, part I: analytical model for sensitivity
S.-J. Park, **J.C. Doll**, and B.L. Pruitt
Journal of Microelectromechanical Systems (2010)

Design optimization of piezoresistive cantilevers for force sensing in air and water
J.C. Doll, S.-J. Park, B.L. Pruitt
Journal of Applied Physics (2009)
Selected for the Virtual Journal of Nanoscale Science & Technology

High-speed multispectral imaging of nanoplasmonic array
G.L. Liu, **J.C. Doll**, L.P. Lee
Optics Express (2005)

Magnetic nanocrescents as surface-enhanced Raman scattering nanoprobes for biomolecular imaging
G.L. Liu, Y. Lu, J. Kim, **J.C. Doll**, L.P. Lee
Advanced Materials (2005)

Selected archival conference publications (14 total, 6 first-author)

Patterned cracks in the buried oxide layer to improve yield in device release from SOI wafers
G.C. Hill, J.I. Padovani, B.W. Chui, H.J. Mamin, D. Rugar, N. Harjee, **J.C. Doll**, B.L. Pruitt
IEEE MEMS Conference, Cancun, Mexico (2011)

Optimization with process limits and application requirements for force sensors
S.-J. Park, **J.C. Doll**, N. Harjee, B.L. Pruitt
IEEE Sensors Conference, Hawaii, USA (2010)

Surface roughness induced hysteresis in adhesive elastic contacts
H. Kesari, **J.C. Doll**, W. Cai, B.L. Pruitt, A.J. Lew
U.S. National Congress of Theoretical and Applied Mechanics, University Park, USA (2010)

Piezoresistive cantilevers optimized for kilohertz force sensing in aqueous solutions
J.C. Doll, B.C. Petzold, M.B. Goodman, B.L. Pruitt
Nanomechanical Cantilever Workshop, Banff, Canada (2010)

Piezoresistive cantilever optimization and applications
J.C. Doll, S.-J. Park, N. Harjee, A.J. Rastegar, J.R. Mallon, B.C. Petzold, et al.
Materials Research Society Fall Meeting, Boston, USA (2009)

A high d_{33} CMOS compatible process for aluminum nitride on titanium
J.C. Doll, B.C. Petzold, B. Ninan, R. Mullapudi, B.L. Pruitt
Transducers Conference, Denver, USA (2009)

High frequency force sensing with piezoresistive cantilevers
J.C. Doll, B.C. Petzold, P. Ghale, M.B. Goodman, B.L. Pruitt
Transducers Conference, Denver, USA (2009)

Measuring thresholds for touch sensation in C. elegans
J.C. Doll, S. Muntwyler, F. Beyeler, S. Geffeney, M.B. Goodman, B.J. Nelson, B.L. Pruitt
Microtechnologies in Medicine and Biology, Quebec City, Canada (2009)
Best abstract award

Invited talks

"MEMS for the investigation of mechanotransduction", University of Neuchatel (2008)

"Integration challenges in MEMS smart sensor fabrication", Sensors in Design, Design West (2012)

Teaching

E240: Introduction to MEMS/NEMS (2010)
Presented a guest lecture on piezoresistance

E341: Micro/Nano systems design and fabrication laboratory (2009)
Cleanroom TA for DRIE and LPCVD oxide fabrication steps

E240: Introduction to MEMS/NEMS (2006)
Co-taught discussion sections, developed assignments and tests, developed a hands-on microfluidics lab exercise

Professional activities

Open-source software

piezoD
Open source software for piezoresistive and piezoelectric sensor design optimization
Additional information at: http://microsystems.stanford.edu/piezod

Journal reviewer

Journal of Micromechanics and Microengineering
Measurement Science and Technology
Nanotechnology
Smart Materials and Structures

Honors, awards, & fellowships

Best Abstract, Microtechnologies in Medicine and Biology (2009)
NSF International Research and Education in Engineering Fellow (2008)
NSF Graduate Research Fellowship (2007)
National Defense Science and Engineering Graduate Fellowship (2007)
McCord Scholarship (2006)
UC Berkeley Biology Fellows Program (2005)