**ROBERT A CROCE JR.**

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# OBJECTIVE

To obtain a full-time research engineering position subsequent to the completion of the Doctor of Philosophy Degree in Electrical Engineering.

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# EDUCATION

# University of Connecticut, Storrs, CT

# *Ph.D.* in Electrical Engineering 3.73/4.0 GPA *Graduation:* May 2012

# *Dissertation Title:* Functionlization and Characterization of Nanomaterial Gated Field-Effect Transistor Based Biosensors and the Design of a Multi-Analyte Biosensing Platform

# *M.S.* in Electrical Engineering 2011

# *B.S.* in Biomedical Engineering 2007

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# RESEARCH AND WORK EXPERIENCE

**Micro/Optoelectronics and Nanotechnology Research Lab,** Storrs, CT, 09/2007 – Present.

*Graduate Research Assistant,* Specializing in Semiconductor Processing, Sensors and Instrumentation

* Design, integration and testing of the internal circuitry of a totally implantable biosensing platform using photovoltaic powering and optical communication links. Worked as part of an interdisciplinary team of researchers from the Department of Electrical Engineering and Pharmacy, and the Institute of Material Science, funded by TATRC, NIH and NSF-SBIR grants.
  + System-level integration of glucose sensors, analog and digital circuitry, optical communication and photovoltaic powering devices, along with the design of the proximity communicator which interfaces with the implantable unit.
  + Successful *in-vitro* and *in-vivo* interfacing of amperometric electrochemical glucose sensors with MOSIS fabricated circuitry.
  + Developed a LabVIEW-based application deployed on a Smartphone to wirelessly receive glucose sensor signals transmitted by the proximity communicator *via* Bluetooth.
  + Designed a LabVIEW-interface for monitoring multiple implanted *in-vivo* glucose sensors.
  + Cadence simulation (TSMC 0.35µm) of various potentiostats, signal processing units, and digital logic circuits*.*
* Computational modeling of implantable multi-layer amperometric glucose sensors (MATLAB).
  + Developed a working model employing finite difference algorithms for solutions to partial differential equations.
  + Modeled both the enzyme layer as well as the layer-by-layer assembled outer polymer membranes for implantable glucose sensors to determine concentration profiles, amperometric response and response times of different devices.
  + Results verified the role of H2O2 diffusion has in determining sensor sensitivity and linearity in multi-layered amperometric glucose sensors based on a previous experimental theory.
* Research and fabrication of nanomaterial gated field-effect transistor (FET) biosensors for protein and DNA sensing applications.
  + Employed carbon nanotube and quantum dot self-assembly methodologies for detecting the protein Thrombin using single-stranded DNA aptamers.
  + Developed various covalent chemical functionalization methodologies for different biomolecule detection.
  + Design and fabrication of microfluidic channels (SU-8 photoresist processing) for solution delivery to the sensors.
* General Semiconductor Processing and Characterization
  + Reactive ion etching, photolithography, plasma-enhanced chemical vapor deposition, wet and dry thermal oxidation, and phosphorous and boron diffusion for the fabrication of silicon-based FETs, non-volatile memories, and solar cells.
  + Finetech Flip-Chip Die Bonding and Kulicke & Soffa ICONN Wirebonder (Level 1 Trained)
* Peer reviewer for the *Royal Society of Chemistry* Journal

**Harvard Center for Nanoscale Systems, and MIT Microsystems Technology Lab,** Cambridge, Ma

*Certified Clean Room User*

* STS ICP RIE, STS PECVD, Denton E-Beam Evaporator, Veeco Dektak Profilometer.

**Cornell Nanoscale Science and Technology Facility,** Ithaca, New York

*Certified Clean Room User*

**Covidien,** North Haven, CT, Summers ‘05, ‘06, and ‘07

*Research and Development Intern*

* Worked with Instron tensile/compression unit using Bluehill and Series IX software in developing the next generation medical suture and auto suture devices.
* Monitored *in-vitro* tests and sat in on *in-vivo* testing of new products.

**TEACHING EXPERIENCE**

**University of Connecticut,** Department of Electrical and Computer Engineering

*Teaching Assistant*

* Nanotechnology Lab (ECE 4244), Spring 2009, 2010, 2011.
* Micro/Opto Electronic Devices and Circuits Laboratory (ECE 4242), Fall 2009, 2010, 2011.
* Young Engineering Scholars Science Program (YESS), Summer 2008, 2009, 2010, 2011.

# COMPUTER LANGUAGES AND SKILLS

# MATLAB, LabVIEW, Cadence Design Environment, C, Microchip MPLAB, P-Spice, Express PCB, Canvas, Origin, Microsoft VISIO, Adobe Photoshop, Linux, Microsoft Office (All Applications).

# AFFILIATIONS AND AWARDS

Biomedical Engineering Society

Surface Mount Technology Association, Diabetes Technology Society

Best Oral Paper, *Connecticut Symposium on Microelectronics and Optoelectronics 2011*

Awarded the 2011 Summer Fellowship for Advanced Graduate Students

Awarded the 2011 Doctoral Dissertation Fellowship

**RELEVANT COURSES**

Electromagnetic Wave Propagation Semiconductor Devices and Models

Nanotechnology VLSI Design and Fabrication

Optoelectronic Devices Bioinstrumentation

# PUBLICATIONS

*PATENTS AND DISCLOSURES*

1. Faquir C. Jain, Robert A. Croce Jr. and Anjana Jain. *Quantum Dot Gate FETs and Circuits configured as Biosensors and Gene Sequencers*. US Patent Application Ser. No: 61/567,507, Filed December 06 2011, US Patent Pending.
2. Faquir C. Jain, Robert A. Croce Jr., Pawan Gogna, Syed K. Islam, Liang Zuo, Kai Zhu and Fotios Papadimitrakopoulos. *Circuit Architecture for an Implantable Multi-function, Multi-analyte Biosensing Platform.* Invention Disclosure Submitted, UConn Center for Science and Technology Commercialization, July 2011.
3. Faquir C. Jain, Supriya Karmakar, Robert A. Croce Jr., Fotios Papadimitrakopoulos and Santhisagar Vaddiraju. *Integrated Solar Cell Array to Power a Miniaturized Implantable Biosensing Platform.* Invention Disclosure Submitted, UConn Center for Science and Technology Commercialization, December 2011.

*JOURNAL PAPERS*

1. Robert A. Croce Jr., Santhisagar Vaddiraju, Pik-Yiu Chan, Rea Setya and Faquir C. Jain, “Label-Free Protein Detection Based on Functionalized Vertically Aligned Carbon Nanotube Gated Field-Effect Transistors,” *Sensors* *and Actuators B: Chemical*, Vol. 160, 1, pp. 154-160, 2011.
2. Robert A. Croce Jr., Santhisagar Vaddiraju, Yan Wang, Liang Zuo, Kai Zhu, Jun Kondo, Diane Burgess, Fotios Papadimitrakopoulos, Syed K Islam and Faquir C. Jain, “A miniaturized transcutaneous system for continuous glucose monitoring,” *Biomedical Microdevices.* **(Article Submitted)**
3. Robert A. Croce Jr., Santhisagar Vaddiraju, Fotios Papadimitrakopoulos and Faquir C. Jain, “Theoretical Analysis of the Performance of Implantable Glucose Sensors with Layer-by-Layer Assembled Outer Membranes”, *Journal of Electroanalytical Chemistry*. **(Article Submitted)**
4. Robert A. Croce Jr., Pik-Yiu Chan, Kavitha Baskar and Faquir C. Jain, “Functionalized Quantum Dot Gate Field-Effect Transistors for Protein Detection”. **(Article in Preparation)**

*CONFERENCE PROCEEDINGS*

1. Robert A. Croce Jr., Santhisagar Vaddiraju, Liang Zuo, Melika Roknshariki, Kai Zhu, Mukesh Gogna, Pawan Gogna, Fotios Papadimitrakopoulos, Syed Islam and Faquir Jain, “Needle-Implantable Biosensing Platform Using Photovoltaic Powering and Optical Communication Links,” *Biomedical Engineering Society Annual Meeting*, 2011, Hartford , CT.
2. Faquir Jain, Supriya Karmakar, Robert A. Croce Jr., Mukesh Gogna, Ernesto Suarez, John Chandy and Evan Heller, “Multi-state Quantum Dot Channel (QDC) Field-Effect Transistors (FETs): A New Paradigm in Circuit Design.” *20011 Nanoelectronic Devices for Security Conference,* August 29-September 1, Brooklyn, N.Y.
3. Robert A. Croce Jr., Santhisagar Vaddiraju, Liang Zuo, Melika Roknshariki, Kai Zhu, Mukesh Gogna, Pawan Gogna, Fotios Papadimitrakopoulos, Syed Islam and Faquir Jain, “Needle-Implantable Platform for Continuous Glucose Monitoring Using Photovoltaic Powering and Optical Communication,” *Diabetes Technology Meeting 2011*, San Francisco, CA.
4. Liangliang Qiang, Santhisagar Vaddiraju, Yan Wang, Robert A. Croce Jr., Diane J. Burgess, Faquir C Jain and Fotios Papadimitrakopoulos, “*Edge-plane microwire electrodes for high sensitive glucose detection”*, *Diabetes Technology Meeting 2011*, San Francisco, CA.
5. Robert A. Croce Jr., Croce, Pawan Gogna,Mukesh Gogna, Ashraf Islam, Liang Zuo, Kai Zhu, Melika Roknshariki, Santhisagar Vaddiraju, Fotios Papadimitrakopoulos, Syed K. Islam and Faquir C. Jain, “Finite-state machine architecture for function selection in an implantable biosensing platform using optical communication”, *Connecticut Symposium on Microelectronics and Optoelectronics 2011*, Yale University, New Haven, CT.
6. Ashraf B. Islam, [Haider, Mohammad R.](http://www.scopus.com/authid/detail.url?authorId=35726579500&eid=2-s2.0-79951802679) Haider, Syed K. [Islam,](http://www.scopus.com/authid/detail.url?authorId=25927242000&eid=2-s2.0-79951802679) Robert A [Croce Jr.,](http://www.scopus.com/authid/detail.url?authorId=36988074200&eid=2-s2.0-79951802679) Santhisagar [Vaddiraju,](http://www.scopus.com/authid/detail.url?authorId=18838920500&eid=2-s2.0-79951802679) Fotios [Papadimitrakopoulos, and Faquir C](http://www.scopus.com/authid/detail.url?authorId=35418592100&eid=2-s2.0-79951802679). [Jain](http://www.scopus.com/authid/detail.url?authorId=7004299865&eid=2-s2.0-79951802679), “A potentiostat circuit for multiple implantable electrochemical sensors” *6th International Conference on Electrical and Computer Engineering, ICECE 2010*, Dhaka, Bangladesh, December 18, 2010 – December 20, 2010.
7. Robert A. Croce Jr., Rea Setya, Pik-Yiu Chan, and Faquir C. Jain, “Carbon Nanotube Gate Si-FETs for Protein Sensing Applications”, *Government Microcircuit Applications and Critical Technology Conference 2010*, March 2010, Reno, Nevada.
8. Darlington C. Abanulo, Liangliang Qiang, Robert A. Croce Jr., Tom Reinwald, John Kahl, Faquir C. Jain and Fotios Papadimitrakopoulos,”Facile Fabrication of Sem-SWCNTs based Thin Film Transistors”, *Connecticut Symposium on Microelectronics and Optoelectronics 2010*, University of Connecticut, Storrs CT.
9. Robert A. Croce Jr., Rea Setya, Pik-Yiu Chan, and Faquir C. Jain, “Protein Sensor Utilizing Functionalized Vertically Aligned Carbon Nanotube Gate FETs,” *2009 Nanoelectronic Devices for Security Conference*, September 28-October 2, Fort Lauderdale, FL.
10. Robert A. Croce Jr., Mukesh Gogna, Fuad Alamoody, Fotios Papadimitrakopoulos and Faquir Jain, “Carbon Nanotube Based Metal Oxide Semiconductor (MOS) Biosensor”. *Connecticut Symposium on Microelectronics and Optoelectronics 2009*, Yale University, New Haven, CT.