

# Mark D. Hempstead

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United Kingdom

## Junior Colehower Chair Assistant Professor

Department of Electrical and Computer Engineering  
Drexel University, Philadelphia PA  
Starting January 2010

## EDUCATION

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### Harvard University, Cambridge MA

S.M Engineering Sciences, June 2005

PhD June 2009, Engineering Sciences in the power-aware architecture and mixed-signal VLSI groups

*Academic Advisors:* Prof. Gu-Yeon Wei and Prof. David Brooks (Co-Advised)

*Research Interests:* Computer Engineering, power-aware computer architecture, low-power VLSI design, wireless sensor networks, accelerator-based architectures, high performance/mobile and low-power embedded

*Dissertation:* "Accelerator-Based Architectures for Wireless Sensor Network Applications"

*Dissertation Committee:* Prof. Gu-Yeon Wei, Prof. David Brooks, Prof. Margo Seltzer

### Tufts University, Medford MA

B.S. in Computer Engineering, May 2003

Summa Cum Laude, GPA 3.81

## RESEARCH EXPERIENCE

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### ARM Ltd., Cambridge UK

#### Research Intern R&D

7/2009 – present

Developing a system level power modeling infrastructure

### Harvard University, Cambridge MA

#### Research Assistant

9/2003 – 6/2009

Modeling of multi-core vs. accelerator-based architectures in the context of future technologies. Investigated low power architecture and circuit techniques for wireless sensor network applications under Prof. Gu-Yeon Wei and Prof. David Brooks. Evaluated architecture and circuit ideas and taped out microprocessor prototypes in 130 nm and 180 nm CMOS and tested the results.

### Intel Corporation, Hudson MA

#### Research Intern, VSSAD Group

5/2005 – 8/2005

Conducted a study of the performance and power tradeoffs of x86 decoding structures. Modified a P6 based simulator and ran extensive simulations of real traces. Prepared a final report for use in future internal projects.

## TEACHING EXPERIENCE

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### Tufts University

#### Lecturer

1/2009 – 6/2009

Hired to teach digital logic systems (EE26) to junior computer engineering students. Lectures on reliable digital design, combinational logic, state-machine minimization, PLAs, FPGAs, and arithmetic and control logic. Lab involves VHDL design and Altera software.

**Harvard University Teaching Fellow**

ES96 Engineering Design (Spring 08) – Prof. Woodward Yang. Seminar for all juniors in engineering. Guided the class as they tackled a real world problem (planning a transportation system for the new Harvard Allston campus) and presented results to university clients.

QR48 BITS (Spring 06, Spring 07) – Prof. Harry Lewis. Harvard Core course on digital technology for non-science majors. Discussed coding theory, signal representation, encryption, current technology policy and future technology directions. Led a weekly section and gave a guest lecture.

ES154 Introduction to Electronics (Fall 05) - Topics include: Op-Amp Circuits, Device Physics, BJT, MOSFET, Single Stage and Multi-stage amplifiers, DC and small signal models, and high-frequency models.

**Resident Tutor, Lowell House Harvard University** – (9/2006 – 6/2009) Living in a undergraduate residence. Responsible for the resident life of 35 undergraduates. Involved in the house community of undergraduate students, faculty, and graduate students. Responsibilities also include academic advising and server/website support.

**OTHER PROFESSIONAL EXPERIENCE**

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**Fairchild Semiconductor, South Portland ME Customer Quality Engineer Co-Op 5/2002 – 8/2002**  
Researched and managed a corporate-wide initiative to provide customer qualification data for the external website. Met with and coordinated the efforts of various groups including IS, Product Lines, and QA.

**Good Shepherd Food-Bank Inc., Auburn ME Director of Information Services 6/98 – 9/2001**  
Technology manager for statewide non-profit corporation. Garnered several technology grants. During the construction of a new three million dollar facility, coordinated all electrical, voice, and data network technology.

**JOURNAL, CONFERENCE AND WORKSHOP PUBLICATIONS**

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**An Accelerator-based Wireless Sensor Network Processor in 130nm CMOS,”** Invited paper. Mark Hempstead, Gu-Yeon Wei, and David Brooks. International Conference on Compilers, Architecture, and Synthesis for Embedded Systems (CASES-09), Grenoble, France, Oct. 2009.

**Navigo: An early-stage model to study power-constrained architectures and specialization** Mark Hempstead, Gu-Yeon Wei and David Brooks. ISCA Workshop on Modeling, Benchmarking, and Simulations (MoBS), June 2009.

**An accelerator-based wireless sensor network processor in 130nm CMOS** Mark Hempstead, Gu-Yeon Wei and David Brooks ISCA Workshop on Architectural Research Prototyping (WARP), June 2009.

**System Design Considerations for Sensor Network Applications (Invited)** Mark Hempstead, Gu-Yeon Wei, and David Brooks. *International Symposium on Circuits and Systems (ISCAS)*. Seattle WA., May 2008. (Invited Session: Energy-Efficient Building Blocks for Ubiquitous Sensing)

**Survey of hardware systems for wireless sensor networks (Invited)** Mark Hempstead, Michael J. Lyons, David Brooks and Gu-Yeon Wei. *ASP Journal of Low Power Electronics*, Vol. 4., No. 1, April 2008.

**Ultra Low Power System Architecture for Wireless Sensor Network Applications** Mark Hempstead, Gu-Yeon Wei, and David Brooks. *Nanoelectronic Devices for Defense & Security Conference (NANO-DDS)*. Washington D.C., June 2007.

**Architecture and Circuit Techniques for Low-Throughput, Energy-Constrained Systems Across Technology Generations**, Mark Hempstead, Gu-Yeon Wei and David Brooks. *In Proceedings of the International Conference On Compilers, Architecture, And Synthesis For Embedded Systems(CASES)*. Seoul South Korea. October 2006.

**Design and Implementation of An Ultra Low Power System Architecture for Wireless Sensor Network Applications (Design Contest)**, Mark Hempstead, Xiaoyao Liang, Patrick Mauro, Gu-Yeon Wei, and David Brooks *SRC Student Symposium – SoC design contest Phase 2, 1<sup>st</sup> place*. Raleigh/Durham NC, October 2006.

**A Realistic Power Consumption Model for Wireless Sensor Network Devices**, Qin Wang, Mark Hempstead, and Woodward Yang. In Proceedings of the Third Annual IEEE Communications Society Conference on Sensor, Mesh and Ad Hoc Communications and Networks (SECON). Reston, VA, September 2006.

**Design and Implementation of An Ultra Low Power System Architecture for Wireless Sensor Network Applications (Design Contest)**, Mark Hempstead, Xiaoyao Liang, Patrick Mauro, Gu-Yeon Wei, and David Brooks *SRC Techcon – SoC design contest Phase 1, 2<sup>nd</sup> place*. Portland, OR, October 2005.

**Power and Thermal Effects of SRAM vs. Latch-Mux Design Styles and Clock Gating Choices**. Yingmin Li, Mark Hempstead, Patrick Mauro, David Brooks, Zhigang Hu, Kevin Skadron. *In Proceedings of the International Symposium on Low Power Electronics and Design (ISLPED'05)*, San Diego, CA, August 2005

**An Ultra Low Power System Architecture for Wireless Sensor Network Applications**, Mark Hempstead, Nikhil Tripathi, Patrick Mauro, Gu-Yeon Wei, and David Brooks *In Proceedings of the 32<sup>nd</sup> International Symposium on Computer Architecture (ISCA)*, Madison, WI, June 2005.

**Simulating the Power Consumption of Large-Scale Sensor Network Applications**, Victor Shnayder, Mark Hempstead, Bor-rong Chen, Geoff Werner-Allen, and Matt Welsh. *In Proceedings of the Second ACM Conference on Embedded Networked Sensor Systems (SenSys'04)*, Baltimore, MD, November 2004

**TinyBench: The Case For A Standardized Benchmark Suite for TinyOS Based Wireless Sensor Network Devices**, Mark Hempstead, David Brooks, and Matt Welsh. *In Proceedings of the First IEEE Workshop on Embedded Networked Sensors (EmNets'04)*, Tampa FL November 2004.

## PRESENTATIONS AND TALKS

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- 6/2009 MOBS at ISCA, Austin Texas – “Navigo: An early-stage model to study power-constrained architectures and specialization”
- 6/2009 WARP at ISCA, Austin Texas – “An accelerator-based wireless sensor network processor in 130nm CMOS”
- “Designing Ultra Low-Power Systems for Wireless Sensor Networks”
- 7/2009 ARM Ltd., Cambridge United Kingdom
  - 6/2009 University of Massachusetts Dartmouth
  - 4/2009 Columbia University
  - 3/2009 Bucknell University
  - 1/2009 Drexel University
  - 10/2008 Tufts University
- 5/2008 ISCAS Seattle WA – “System Design Considerations for Sensor Network Applications”
- 6/2007 NANO-DDS, Washington DC – “Ultra Low Power System Architecture for Wireless Sensor Network Applications”
- 10/2006 SRC Student Symposium, Raleigh/Durham NC – “Design and Implementation of An Ultra Low Power System Architecture for Wireless Sensor Network Applications”

- 10/2006 CASES, Seoul South Korea – “Architecture and Circuit Techniques for Low-Throughput, Energy-Constrained Systems Across Technology Generations”
- 10/2005 SRC Techcon, Portland OR – “Design and Implementation of An Ultra Low Power System Architecture for Wireless Sensor Network Applications”
- 6/2005 ISCA, Madison WI – “An Ultra Low Power System Architecture for Wireless Sensor Network Applications”

## **PATENTS**

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US Patent Application US 2007/0214374 A1 “Ultra Low Power System for Sensor Network Applications.”

## **PROFESSIONAL SERVICE AND REVIEWS**

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### **Reviewer:**

ASP Journal of Low Power Electronics  
IEEE Transactions on CAD  
Transactions on Sensor Networks  
SenSys 2008  
ACM Computing Frontiers (CF) 2008  
ISPASS 2007, 2006  
ISLPED 2007, 2006, 2005  
IISWC 2006  
HPCA 2006  
MASS 2006  
ISCAS 2006

## **FUNDING**

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SRC 2006 Design Contest 1<sup>st</sup> Place – \$30,000  
SECON 2006 Travel Grant  
ISCA 2005 Travel Grant

Assisted with proposal submissions: DARPA YFA, NSF NOSS, NSF NET-NOSS, NSF ITR

## **HONORS AND MEMBERSHIPS**

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2006 SRC Design Contest 1<sup>st</sup> Place - included free fabrication in IBM 180nm CMOS  
Member Eta Kappa Nu – Electrical Engineering Honor Society.  
Member Tau Beta Pi – Engineering Honor Society  
IBM Thomas Watson Scholar – Funding for Undergraduate Degree  
**Certifications:** Registered Engineer in Training (FE) - State of Massachusetts  
**Memberships:** IEEE, ACM, IEEE Computer Society, ACM SIGARCH

## **LEADERSHIP, ACTIVITIES, INTERESTS**

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Long Distance Running, Travel, Piano, Hiking, Camping  
Graduate Student Life Committee, Harvard SEAS – Co-President (Jan 2006 – Jan 2008)  
Tufts Mountain Club: Trip Leader, Communications Director (2001 – 2002)  
Tufts Theater: Sound Designer or Accompanist involved in fourteen productions (1999 – 2003)  
Tufts Wilderness Orientation: Staff & Trip Leader (2001-2002)  
Boy Scout Troop 35 Yarmouth: Eagle Scout, Assistant Scout Master (1993 – 1999)

