Abhiman A. Hande, Ph. D.

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Research Interests

- **Power Electronics:** Design of switch mode DC-DC converters; High frequency inverter design; Power management circuits for sensor network nodes.
- **Ambient Intelligence:** Low power sensor networks; Energy harvesting and storage; Applications in biomedical, automation, and security.
- **Embedded Systems:** Microcontroller-based systems; High level and assembly level microcontroller programming; Design of peripheral analog and digital circuits.
- **Automotive Electronics:** Design of EV and HEV battery management systems; High accuracy transfer circuits for voltage measurement; Thermal management for batteries; Battery testing during EV/HEV cycle simulations.

Education

- Ph.D. in Electrical Engineering, University of Toledo, December 2002.
- M.S. in Electrical Engineering, University of Toledo, May 2000.
- B.S. in Electrical Engineering, University of Mumbai, India, December 1996.

Appointments and Experience

- **Research Associate** **Aug.2005 - present**
  Electrical Engineering Department, University of Texas-Dallas (UTD)

  Implementing various energy harvesting and power management techniques to power ubiquitous low power wireless sensor nodes via solar and vibrational energy. Also, involved in designing switch mode power supplies (buck, boost, and buck-boost) that use a new feedback linearization technique.

- **Assistant Professor** **Jan.2003 – Aug.2005**
  Electrical and Computer Engineering Department, Lake Superior State University (LSSU)

  Courses taught: Electronic Design, Digital Fundamentals, Microcontroller Fundamentals, Microcomputer Systems, Digital Design, C Programming, Introduction to Engineering, Senior Design Projects I and II.

- **Teaching Assistant** **Aug.2002 - Dec.2002**
  Department of Electrical Engineering and Computer Science, University of Toledo

  Assisted faculty in teaching the EECS-5260 Control Systems Design and EECS-3400 Electronics I courses.

- **Research Assistant** **Aug.1998 - Jul.2002**
  Power Electronics Laboratory (PEL), University of Toledo

  Worked on various vehicular embedded systems projects with a focus in battery management for EVs and HEVs. I was also involved in design of DC/DC, AC/DC and DC/AC converters for battery equalization, pre-heating, and charging. These projects were funded by DaimlerChrysler and Department of Energy's National Renewable Energy Laboratory (NREL).

- **Electrical Engineer** **Jul.1996 - Jun.1998**
  Electrical Engineering Department, RPG Cables Ltd., Mumbai, India

Designed and implemented an Automatic Power Factor Correction Panel and optimally distributed generator loads for improving plant energy efficiency.

- **Engineering Intern** **Jul.1995 – Jun.1996**
  Electrical Engineering Department, Godrej Soaps Ltd., India., Mumbai, India
  Installed a 1000 kVA distribution substation as part of a team under a chief engineer. Designed the substation layout along with appropriate switchgear, transformer, capacitor banks, and cables.

Research

Research Projects

- **Energy Scavenging Methodologies for Wireless Sensor Nodes** **Aug. 2005 - present**

  Presently, in the process of implementing energy harvesting circuits for wireless sensor nodes and developing a smart power management scheme. Prototype circuits that harvest energy from ambient light and vibrations have been implemented. TI MSP430 and Chipcon CC2420 based motes are being designed along with an energy efficient wireless protocol similar to Zigbee. Applications in the biomedical and environmental arenas are being targeted. This undertaking also involves design of a low power linear regulator and is funded in part by UTD and TI.

- **Implementation of Fixed Frequency PWM Converters with Feedback Linearization** **Aug.2005-present**

  We are in the process of designing 50-75W buck, boost and buck-boost DC/DC converters using a new feedback linearization control technique (with leading edge modulation) rather than using traditional PID controllers (with trailing edge modulation). The algorithm has been simulated using Simulink and will be implemented on a Xilinx Spartan-II FPGA. This project is internally funded and assisted by Dr. Robert Taylor (Technical Manager, Tyco Electronics Power Systems).

- **A Wireless Smart House Application (WSHA)** **Jan.2004 – Aug.2005**

  The WSHA is basically a wireless home network that utilizes the Zigbee wireless protocol to control HVAC and lighting loads in the household. Several nodes will be distributed in the household with each node controlling specific loads that are in close proximity to it. This project was partly funded by LSSU's School of Engineering and Technology and IEEE Region 4.

- **A Low Voltage Regulator for Dual Voltage Automotive Electrical Systems Jan.2003 – Jan.2004**

  Programmed the Infineon C505C-L microcontroller and built necessary hardware to implement a scheme where the 14V bus is provided by a 14V tap on a 42V battery instead of using a conventional DC/DC converter for providing the 14V bus.

- **AC Battery Heating for Cold Climates (Ph.D. dissertation)** **Mar.2000 – Dec.2002**

  Developed methods to internally heat EV/HEV batteries at cold temperatures using high frequency AC currents. A high frequency 10-20 kHz inverter was designed for warming nickel metal hydride (NiMH) batteries. Additional tests need to be conducted to document the effect of high frequency AC currents on battery life. This project was conducted at PEL and funded by NREL.

- **A Selective Boost Equalizer for NiMH Batteries (M.S. thesis)** **Aug.1998 - March 2000**

  Designed a relay matrix for charging weak EV/HEV batteries in a "round robin" manner. Programmed the Motorola M68376 microcontroller for sensing the voltage and temperature of each battery module, and controlling the switching of relays in the relay matrix. Designed and built

necessary hardware and displayed data on a remote personal computer using Visual Basic. This project was conducted at PEL and funded by NREL.

- **A Modular Battery Management System (MBMS) for HEVs** **Aug.1998-Mar.2001**

  Worked in a team of engineers to design an MBMS for a 128V Li-ion battery pack. The system consisted of four local modules (LMs) that managed four sections (32V) of the pack and were controlled by a central module (CM) via CAN. Each LM used the above equalizer to boost weak batteries from a DC/DC converter. This project was funded by DaimlerChrysler.

Professional Publications

Refereed Journal Publications

1. **A. Hande**, T. Polk, W. Walker, and D. Bhatia, "Indoor Solar Energy Harvesting for Sensor Network Router Nodes", article in press, *Journal of Microprocessors and Microsystems - Special Issue on Sensor Systems*.
2. **A. Hande** and S. Kamalasadan, "An Electromechanical Transfer Circuit to Measure Individual Battery Voltages in Series Packs", *Journal of Power Sources*, Vol.162, Issue.1, pp. 719-726, November 2006.
3. **A. Hande**, T. Polk, W. Walker, and D. Bhatia, "Self-powered Wireless Sensor Networks for Remote Patient Monitoring in Hospitals", *Sensors Journal*, Vol.6, Issue.9, pp. 1102-1117, 2006.
4. **A. Hande**, "Internal Battery Temperature Estimation using Series Battery Resistance Measurements during Cold Temperatures", *Journal of Power Sources*, Vol.158, Issue.1-2, pp. 1039-1046, August 2006.
5. **A. Hande** and T. Stuart, "A Selective Equalizer for NiMH Batteries", *Journal of Power Sources*, Vol.138, Issue.1-2, pp. 327-339, November 2004.
6. T. Stuart and **A. Hande**, "HEV Battery Heating using AC currents", *Journal of Power Sources*, Vol.129, Issue.2, pp. 368-378, April 2004.

Refereed Conference Publications

7. T. Polk, W. Walker, **A. Hande**, and D. Bhatia, "Wireless Telemetry for Oxygen Saturation Measurements", *IEEE Biomedical Circuits and Systems (BiOCAS) Conference*, London, UK, November 2006.
8. T. Polk, W. Walker, **A. Hande** and D. Bhatia, "Remote Blood Pressure Monitoring Using a Wireless Sensor Network", accepted for publication, *6th Annual IEEE Emerging Information Technology Conference*, Dallas, TX, August 2006.
9. A. Srivastava, S. Kamalasadan, and **A. Hande**, "Comparative Performance of Improved Shrinking Span Fuzzy Logic Controller", *IEEE Southeastern Conference*, pp. 16-21, Memphis, TN, April 2006.
10. **A. Hande**, S. Kamalasadan, and A. Srivastava, "A Selective Voltage Measurement System for Series Connected Battery Packs", *IEEE Southeastern Conference*, pp. 22-27, Memphis, TN, April 2006.
11. **A. Hande**, W. He, N. Barakat, and M. Carroll, "Product Dissection: An Important Tool during a First Year Introduction to Engineering Project", *ASEE North Central Section 2005 Conference, Ohio Northern University*, Ada, OH, April 7-8, 2005.
12. **A. Hande** and T. Stuart, "Effects of High Frequency AC Currents on Cold Temperature Battery Performance", *2nd IEEE India International Congress on Power Electronics (IICPE 2004)*, Mumbai, India, December 20-21, 2004.

13. S. Kamalasadan and **A. Hande**, "A PID Controller for Real-Time DC Motor Speed Control using the C505C Microcontroller", *17th International Conference on Computer Applications in Industry and Engineering (CAINE)*, pp.34-39, Orlando, FL, November 17-19, 2004.
14. **A. Hande** and T. Stuart, "A Selective Boost Equalizer for Series Connected NiMH Battery Packs", *8th IEEE Workshop on Power Electronics in Transportation (WPET 2004) Conference*, Detroit, MI, October 21-22, 2004.
15. **A. Hande** and T. Stuart, "A Round Robin Algorithm for an Embedded Electronic Battery Equalizer", *IEEE Region 4 Electro/Information Technology (EIT 2004) Conference*, Milwaukee, WI, August 26-27, 2004.
16. **A. Hande**, "A High Frequency Inverter for Cold Temperature Battery Heating", *9th IEEE Workshop on Computers in Power Electronics (COMPEL '04) Conference*, University of Illinois, Urbana-Champaign, IL, August 15-18 2004.
17. T. Stuart and **A. Hande**, "AC Heating for EV/HEV Batteries", *7th IEEE Workshop on Power Electronics in Transportation (WPET 2002) Conference*, pp.119-124, Detroit, MI, October 24-25, 2002.
18. T. Stuart and **A. Hande**, "AC Battery Heating for Cold Climates", *Environmental Vehicle (EnV 2001) Conference*, Engineering Society of Detroit, Southfield, MI, June 10-13, 2001.

Teaching

Courses Taught

Semester	University	Course Number / Name	Course Level	Credit Hours	Enroll-ment	Notes
Fall 2006	University of Texas at Dallas	EE 7V81 – Biomedical Electronics	Graduate	3	9	New Prep.
Spring 2005	Lake Superior State University	EE 355 - Microcontroller Systems	Junior / Senior	4	10	Major Re-development
Spring 2005	Lake Superior State University	EE 125 - Digital Fundamentals	Fresh.	4	35	
Spring 2005	Lake Superior State University	ET 175 - Applied Electronics	Soph.	4	10	New Prep.
Fall 2004	Lake Superior State University	EE 320 - Digital Design	Junior / Senior	4	22	New Prep.
Fall 2004	Lake Superior State University	EE 250 - Microcontroller Fundamentals	Soph.	4	12	
Fall 2004	Lake Superior State University	EG 101 - Introduction to Engineering	Fresh.	2	52	
Spring 2004	Lake Superior State University	EE 375 - Electronic Circuits	Junior / Senior	4	11	
Spring 2004	Lake Superior State University	EE 125 - Digital Fundamentals	Fresh.	4	38	
Spring 2004	Lake Superior State University	EG 265 - "C" Programming	Soph.	3	31	
Spring 2003	Lake Superior State University	EG 495 - Engineering Design Projects II	Senior	3	35	
Fall 2003	Lake Superior State University	EE 250 - Microcontroller Fundamentals	Soph.	4	20	Major Re-development

Semester	University	Course Number / Name	Course Level	Credit Hours	Enroll-ment	Notes
Fall 2003	Lake Superior State University	EG 101 - Introduction to Engineering	Fresh.	2	55	New Prep.
Fall 2003	Lake Superior State University	EG 265 - "C" Programming	Soph.	3	29	
Fall 2003	Lake Superior State University	EG 491 - Engineering Design Projects I	Senior	3	35	
Spring 2003	Lake Superior State University	EE 375 - Electronic Circuits	Junior / Senior	4	6	New Prep.
Spring 2003	Lake Superior State University	EE 125 - Digital Fundamentals	Fresh.	4	39	New Prep.
Spring 2003	Lake Superior State University	EG 265 - "C" Programming	Soph.	3	19	New Prep.
Fall 2002*	University of Toledo	EECS 4260/5260 - Control Systems Design	Senior / Grad.	3	20	
Fall 2002*	University of Toledo	EECS 3400 - Electronics I	Junior	4	20	
Fall 2002*	University of Toledo	EECS 1050 - Introduction to Computing in C/C++	Fresh.	2	20	

* Assisted faculty as a Teaching Assistant

Educational Activities at UTD

- Designed and developed a new Special topics in Digital Systems course for graduate students entitled "EE 7V81 - Biomedical Electronics" during Fall 2006. The course focuses on the design of high precision biomedical sensors and discusses the advantages of using FPGAs and DSPs for fast data processing.

Educational Activities at LSSU

- Revised and taught the following courses: EE250 - Microcontroller Fundamentals, EE355 - Microcontroller Systems, EE125 - Digital Fundamentals, EE375 - Electronic Circuits
- Taught multiple sessions on computer data acquisition and soldering electronic components on PCBs during LSSU's summer camps for high school students during Summer 2004 and 2005.
- Co-advisor for an engineering team that designed a system to collect data from a variety of analog and digital sensors for display and storage for Continental Teves during the 2004-05 academic year.
- Faculty advisor for an engineering team that designed and built two separate brake component testing systems for Continental Teves during the 2003-04 academic year. Total project funding equaled $40,000.

Accreditation Related Activities at LSSU

- Assessed electrical and computer engineering courses for the School of Engineering and Technology every semester in order to satisfy the required ABET criteria and school's educational objectives.
- Prepared the Electrical Engineering (EE) Professionalism Report for the Manufacturing Engineering Technology TAC/ABET visit during Fall 2004. This report used specific indicators to identify the trends in professionalism in LSSU's EE courses over the past five years (Fall 1999 - Spring 2004).

Professional Memberships, Awards, and Distinctions

Professional Memberships

- Member, American Society for Engineering Educators (ASEE), 2004 - present.
- Associate Member, Society of Automotive Engineers (SAE), 2001 - present.
- Member, Institute of Electrical and Electronics Engineers (IEEE), 1999 - present.
- Member, IEEE Power Electronics Society (PELS), 1999 - present.
- Member, IEEE PELS Dallas Chapter, 2006 - present.

Committee Memberships

- UTD Center of Integrated Circuits and Systems (CICS), August 2005 – present.
- LSSU Engineering Faculty Search Committee, January 2005 – August 2005.
- LSSU Manufacturing Engineering Technology TAC/ABET Assessment Committee, April 2004 - August 2004.
- LSSU Engineering Senior Projects Faculty Board Committee, August 2003 – August 2005.
- LSSU Instructional Technology Task Force Committee, August 2003 - August 2005.

Professional Organization and Association Offices

- Faculty Advisor/Counselor, LSSU IEEE and SAE student chapters, Aug.2004 – Aug.2005.
- Reviewer, Journal of Power Sources, Journal of Microprocessors and Microsystems, IEEE Power Electronics Letters Journal, and Thomson Delmar Learning, Jan.2004 - present.
- Consultant, Destiny Automation Inc., Detroit, MI, May2004 - Aug.2004

Awards and Recognition

- Guest speaker, "Energy Harvesting for Mobile and Wireless Electronics", IEEE Dallas Section April 2007 Meeting.
- "First Place Best Paper Award", IEEE Region 4 Electro/Information Technology (EIT 2004) Conference, Milwaukee, WI, August 26-27, 2004.
- "Outstanding Research Award", University of Toledo Graduate Student Assembly Awards 2001-02, Toledo, OH, April 2002.
- Guest speaker, "On-going Research Activities in the Field of Power Electronics for Hybrid Electric Vehicles", University of Toledo EECS Fall Graduate Seminar, Aug.2001-Aug.2003.
- Graduate Assistantship for M.S. and Ph.D., Dept. of Electrical Engineering and Computer Science, University of Toledo, Ohio, Aug.1998 – Dec.2002.

Supervised Research at UTD *(with Dr. Dinesh Bhatia as primary advisor)*

- Dhaval Shah, M.S. student, "FPGA Implementation of Fixed Frequency PWM Converters with Feedback Linearization", expected to graduate in December 2007, UTD.
- Todd Polk, Ph.D. student, "Self-Powered Wireless Sensor Networks for Telemedicine Applications", expected to graduate in December 2007, UTD.
- Joel Votaw, M.S. student, "An Asynchronous Microprocessor for Low-Power Wireless Sensor Nodes", expected to graduate in August 2007, UTD.

Personal Information

US Permanent Resident, Married with one daughter.

References Available