

MICHAEL D. FORTNEY

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Qualification Summary

Five years experience with instrumentation design for sounding rocket, KC-135 micro-gravity, BalloonSat, and CricketSat flights. Over 20 years experience in the electronic industry developing hardware and software relating to instrumentation, controllers and VLSI integrated circuit design. Fluent in methods of designing, assembling, repairing, calibrating and testing printed circuit boards. Experience with high school and college students in a laboratory setting for the assembly and debug of circuits, specifically CricketSat based wireless sensor and actuator systems.

Citizenship

United States: Born in Freeport, Illinois

Education

MS Candidate in Electrical Engineering College of Engineering and Mathematics, University of Vermont, Burlington

- Expected Graduation: August 2005 GPA 3.65 / 4.0
- Focus: Analog Circuit and Wireless Sensor Design
- Thesis: *A Low-Cost Linear Response Wireless Temperature Sensor for Extreme Environments*
- Advisor: Dr. Jeff Frolik

BS in Electrical Engineering University of Vermont, Burlington, 2000

- Cum Laude GPA 3.64 / 4.0
- Focus: VLSI Circuit Design

AAS in Electronics Richland Community College, Decatur, Illinois, 1980

Relevant Experience

Research Assistant:
Wireless Sensor
Design
Spring 2005 - Present

CricketSat wireless sensor development. Work involves adaptations of the CricketSat sensor to provide additional sensing capabilities and improvements for accuracy and performance in extreme environments up to an altitude of 30 km. Advisor: Dr. Jeff Frolik.

Teaching Assistant:
Freshman Design
Experience
Spring 2005

Redesigned the CricketSat sensor to ease the assembly process and to facilitate adaptations for alternative uses. Students were required to assemble CricketSat sensors solo, and to develop team projects utilizing the CricketSat as a wireless link. The 68 students formed 18 team projects of their own designs. Performed the following duties for the class:

- Provided a lecture on the CricketSat sensor
- Composed an illustrated PowerPoint CricketSat assembly manual
- Assisted students with CricketSat assembly and debug
- Guided students to develop practical design goals
- Designed custom electronics for most projects
- Assisted students with circuit understanding, documentation, assembly, debugging and testing of their designs
- Developed the UVM CricketSat web site: <http://www.uvm.edu/~cricksat>

Vermont Space Grant
– HELiX / EPSCoR
Student Outreach:
2003 - Present

High school outreach program using the CricketSat and BalloonSat programs to perform atmospheric measurements. Co-instructed one-week class followed by multiple BalloonSat launches over the course of a year. Modified basic CricketSat sensor in 2003 for use as humidity, air pressure and light sensors. Designed multi-CricketSat array systems. Assisted students with their research projects, involving development and testing of these systems and improved CricketSat sensor designs.

The 2003 project involved the development of two wireless weather stations to study lake effect on temperature. My work involved the design and construction of a radiation shield for housing the CricketSat sensors, a solar-powered power system, and a low-cost receiver for data collection.

The 2004 workshop involved day and night flights of various CricketSat sensors. A participating Boston area high school won the First Place award in the Massachusetts State Science Fair for the presentation of those results. The 2004 research project, performed by the local Milton High School, was the development of a CricketSat array system to provide live data during a BalloonSat flight. A Collaborative effort with the Medgar Evers College was formed to provide the BalloonSat support. My work involved design assistance, BalloonSat preparation, launch, tracking and recovery. Results are detailed in the ASEE conference paper cited below.

Student Satellite
Workshop
June 2004

Participated in the "Starting Student Space Hardware Programs" workshop, held in Boulder, last summer. Our teams' payload flew aboard the Borealis BOR0406A flight, collecting good data and taking wonderful pictures.

NASA Student
Launch Program
1999 - 2000

Participated as a team member to develop a payload experiment that flew multiple times aboard a KC-135 aircraft and finally aboard a NASA sounding rocket. Developed and improved sensors signal conditioning, battery charging, control and monitoring circuitry. Mentored undergraduate students who were assisting with the design. Designed circuitry used to synchronize data collection between HOBO data loggers. Performed micro-gravity payload experiments aboard a KC-135 flight. Designed Ground Support Equipment (GSE) to control and monitor payload prior to rocket launch. Participated in final payload preparations and rocket launch at NASA Wallops facility.

EDSAT
Communications
Satellite - 1986

Team member assisting with the development of this student built satellite at Richland Community College. Designed and tested an FPGA programmable logic IC to convert measurement data to Morse code. Project was cancelled following the Challenger disaster.

Research Interests

CricketSonde

Development of a radiosonde type unit composed of CricketSat sensors, as an inexpensive instrument platform is in progress. Methodology of segregating data verified during MHS-3 BalloonSat flight, July 2004. Power sequencing circuit developed during the UVM Freshman Design Experience class to be used to replace expensive BASIC Stamp controller. This low-cost design would allow atmospheric measurements to be performed by high school and college students in real-time. Logistics and costs of tracking system would be avoided.

An advanced, recoverable version would employ a low-cost GPS. Data would be converted onboard to the proper units and transmitted using a reduced Morse code format, and possibly a modem. Additional data from the GPS would be parsed including bearing and speed. Capabilities could be added to control the flight as a function of external conditions, such as altitude or position. This system would allow a larger audience of schools and amateur radio operators to participate in the flight and collect results. The CricketSonde data could be used to increase the temporal and spatial resolution of meteorological data collected by the National Weather Service radiosondes.

I have been in correspondence with Dr. Neal Brown, University of Alaska, concerning these issues, since we share many of the same goals for the use of CricketSat.

Additional Experience

Research Assistant:
Musculo-Skeletal
Laboratory
2002 - 2004

Instrumentation design for Drosophila and spinal structural research

- Work performed for Dr. Tony Keller
- Implemented a voice coil actuator system for spine stress-strain research

- Developed a six-channel signal conditioning board to measure distribution of forces during walking and running gates on a force plate
- Drosophila hypergravity centrifuge - To study the effect of hypergravity on Drosophila motility
 - Implemented a embedded web controller to provide a wireless interface with experiment while operating

Graduate Level
Design Project:
Spring 2003

Team member designing a Sigma-delta A/D converter IC. Performed schematic entry, simulation and layout of the design.

Teaching Fellowship
Spring 2002

Teaching assistant for the UVM EE222 course, "Principles of VLSI Analog circuit Design". Assisted students and graded papers.

Teaching Fellowship
Fall 2000

Instructed Junior EE laboratory sessions concerned with bipolar / FET devices and IC circuits.

International Business Machines, Essex Junction, Vermont 1982 to 1999, 2001

DRAM Designer
2001

Participated as a team member involved in the development of an embedded DRAM IC design. Coordinated and assisted in the design and simulation of the on-chip power system, working closely with an experienced analog designer. Performed schematic entry, simulation and testing of analog circuits. Performed physical floor planning and guiding layout designers concerning sensitive circuits.

Mixed Signal Logic
Designer
1998 - 1999

Participated as a team member involved with the development of a mixed signal IC design. Performed schematic entry, simulation, physical layout, and testing of circuits.

DRAM
Characterization
Tester Development
1982 - 1998

Custom IBM in-house tester development for DRAM memory characterization. Spent 16 years involved with the design of circuits and software. Performed schematic entry, simulation and PCB layout of circuits. Assembled and debugged circuit boards. Developed user and hardware interface software for the tester.

**Part-time
Consulting Work**

Bee Cool Ventilator Systems, North Ferrisburg, Vermont 1999 to Present

- Developed solar-powered smart battery charger for lead acid batteries.
- Developed a beehive ventilation controller.
- Setup web server for company web sites

OMNI Measurement Systems Inc., South Burlington, Vermont 1998 to Present

- Designed various micro controller based circuits
 - NiMH and NiCad battery smart chargers
 - DC-DC voltage multiplier
 - Battery fuel-gauging
 - Motor control
 - Tilt meter using MEMS accelerometer IC
- Developed initial corporate website.

Proficiencies

Operating systems: UNIX, AIX, Windows and DOS
Computer languages: Java, Visual Basic, C++, Basic, and Pascal
Applications: MS Office, Matlab, SPICE, Verilog, Verilog-A, VHDL
CAD tools: Express PCB Schematic and PCB Layout, Cadence, IBM EDA tools
Equipment: Multimeters, Analog and Digital Oscilloscopes, Logic and Spectrum Analyzers, GPS units and amateur radio equipment
Assembly: Soldering and de-soldering, debugging, mechanical aptitude
Other: Technician Class Amateur Radio License, Passed General Class Exam

Awards

- NASA Student Satellite Program Award - Vermont Space Grant Consortium 2004
- NASA Reduced Gravity Student Flight Opportunity Award – VSGC 2000
- UVM Atwater Kent Prize in Electrical Engineering 2000
- UVM Junior Electrical Engineering Award 1999
- IBM Invention Achievement Award for Real-Time-Display Development 1992

Journal Publications

- An Infrared System for Monitoring Drosophila Motility During Microgravity. M.S. Miller, M.D. Fortney, T.S. Keller. *Journal of Gravitational Physiology*, 9:83-91, 2002.

Publication Work in Progress

- A Low-Cost Linear Response Wireless Temperature Sensor for Extreme Environments, M.D. Fortney, J.L. Frolik, *IEEE Transactions on Circuits and Systems II*
- A Low-Cost Wireless Platform for First Year, Interdisciplinary Projects, J.L. Frolik, M.D. Fortney, *IEEE Transactions on Education*

Conference Papers

- Adaptation of a Low-cost Wireless Sensor for Freshman and Outreach Programs. M.D. Fortney, J.L. Frolik. 2005 ASEE New England Section Conference. Online: http://www.uvm.edu/~cricksat/documents/ASEE_FORTNEY_final.doc

Presentations

- “Student Space Hardware Programs”, Vermont Astronomical Society, April 2005
- “CricketSat and Beyond”, Northeast Regional Space Grant Meeting, South Burlington, Vermont, October 2004
- “The CricketSat Program at UVM”, Vermont Space Grant Awards Ceremony, October 2004

Professional

IEEE member

Letters of Recommendation

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