

Charles Birdsong, Ph.D.

Professor

Mechanical Engineering Department
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Education

Ph.D. Mechanical Engineering

November 1999

Michigan State University, East Lansing, Michigan Advisor: Clark Radcliffe, Focus: System Analysis and Controls, Active Noise Control. Dissertation topic: Active Noise Control with a Semi Active Helmholtz Resonator

M.S. Mechanical Engineering

December 1996

Michigan State University, East Lansing, Michigan

Advisor: Clark Radcliffe, Focus: System Analysis and Controls, Active Noise Control

B.S. Mechanical Engineering

June 1991, graduated Cum Laude

California Polytechnic State University at San Luis Obispo, California,

Academic Experience

PROFESOR 9/2013-PRESENT

ASSOCIATE PROFESSOR 9/2008 – 9/2013

ASSISTANT PROFESSOR 1/03 – 9/2008

Mechanical Engineering, California Polytechnic State University, San Luis Obispo, 1/03 – present. Full time tenure track faculty position.

DEPT. OF MECHANICAL ENGINEERING, MICHIGAN STATE UNIVERSITY (MSU) 9/94 – 5/99

CONSULTANT FOR UNDERGRADUATE CONTROLS AND VIBRATIONS LABRATORY 9/97 – 12/97

Responsible for training new laboratory teaching assistants and supervisors to provide continuous quality in undergraduate Controls and Vibrations laboratories.

TEACHING ASSISTANT SUPERVISOR UNDERGRADUATE CONTROLS LABORATORY 9/95 – 9/97

Managed Undergraduate Controls Labs. Managed up to 6 graduate teaching assistants per semester. Scheduled and managed as many as 8 sections per semester, acted as mediator between students and faculty representative during disputes. Managed grade databases for 70+ students. Revised and authored new laboratory manuals. Maintained, repaired, and appropriated new laboratory hardware. Managed and authored new software for laboratory experiments including Labview, Matlab, Simulink, Real Time Toolbox for rapid prototype of digital signal processors, Mathematica, and various other software tools.

TEACHING ASSISTANT - LECTURER FOR UNDERGRADUATE CONTROLS COURSE 6/96 – 9/96

Instructor for senior level, undergraduate Automatic Controls course. Reported directly to department chairman. Prepared lectures, wrote exams, and homework assignments. Graded exams and reported final grades. Managed 6 teaching assistants for the course lab. Initiated and authored course information web page.

TEACHING ASSISTANT UNDERGRADUATE AUTOMATIC CONTROLS LABORATORY 9/94- 9/95

Instructed multiple laboratory sections including lecturing course material, instructing and guiding students in experimental procedures, long form reports, and grading quizzes and reports.

TEACHING ASSISTANT FOR UNDERGRADUATE VIBRATIONS LABORATORY 9/93 - 9/94

Instructed multiple laboratory sections including lecturing course material, instructing and guidance in experimental procedures, long form reports, and grading quizzes and reports.

GUEST LECTURER 1996-1999

Guest lecturer for senior level undergraduate courses including, System Modeling - Bond Graph Modeling Techniques for Dr. Ronald Rosenberg, Theory of Vibrations for Dr. Micheal Hales, and graduate level Digital Data Acquisition (Mechatronics) for Dr. Clark Radcliffe.

COMPUTER ADMINISTRATION 1995 – 1999

Web Page Authoring and Server Management for department information systems. Authored the Dynamic Systems Laboratory web site (<http://meweb.egr.msu.edu/home/index.html>) including the technical paper archive. Managed the local area network which included 15 computers in graduate and undergraduate laboratories.

Sponsored Projects

Low Cost Collision Avoidance Detection 2015

Developed an electronic sensor system that integrates low cost sensors such as magnetometers, ultrasonic, gyroscopic sensors to detect the presence of collision threats near a commercial truck or car. Funded by the Gas Technology Institute.

Collision Avoidance Autonomous Vehicle 2015

Developed a hardware in the loop simulator for a 1/10th scale car system that demonstrates automatic collision avoidance in automobiles. The system allows the vehicle to be driven in a virtual environment so that the vehicle can be subjected to identical conditions while testing changes in the software algorithm.

Crash Barrier Testing 2013

Developed data acquisition system for lab based plastic bottle filled highway crash barrier testing system.

Using Potential Fields for Automotive Collision Avoidance Path Planning 2013

Investigated applying the method of potential fields to the area of path planning for collision avoidance in automobiles. Developed computer simulation to optimize and test the algorithm under various road conditions.

Collision Ground Avoidance System for Commercial Airplanes 2013

In partnership with NASA, investigated implementing a ground collision avoidance system for general aviation airplanes using a mobile phone to measure the telemetry data, process the data and alert the pilot of likely collisions and advise flight course changes.

Vehicle Modeling Validation with CarSim 2013

Used the commercial software CarSim to validate a vehicle dynamic model developed in previous work. Also developed a CarSim based model for a 1/10th scale remote controlled car for implementing collision avoidance projects.

MPC Based Rollover Stability Controller in Autonomous Collision Avoidance Vehicle 2010

Implemented model prediction controller to avoid rollover conditions in a 1/10th scale autonomous collision avoidance vehicle.

Collision Avoidance Vehicle 2010

Modified a 1/10th scale remote controlled vehicle to develop a platform for implementing and testing automatic automobile collision avoidance systems. Added wheel encoders, LIDAR sensor and microcontroller to the vehicle. Developed algorithm that allows an operator to drive the vehicle from a remote station, when a collision is imminent, the vehicle automatically plans and implements a safe path around the obstacle, then returns control to the driver. Project won 1st place at the Enhanced Safety of Vehicles Student Design Competition in Seoul Korea.

Vehicle Dynamics Modeling 2008

Investigated vehicle dynamic modeling. I am investigating various models that take inputs such as steering angle, traction and braking force and compute trajectories of the vehicle and tire forces. I am also investigating simulation visualization tools to help visualize the vehicle motion in a realistic 3D environment. I plan on using this research to support the Truck Crash Avoidance and also seek external funding for a project related to designing a crash avoidance system that accounts for vehicle dynamics in addition to sensors and algorithm development.

Sensor Integration for Low Cost Crash Avoidance 2008

Funding: National Academy of Science, IDEA Safety Program

Developed obstacle detection system for class 8 overland transportation trucks using sensor integration of low cost sensors.

Vision Systems and Image Processing 2007

Investigated applying vision systems and image processing to vehicle safety, defense and border patrol and other applications.

Tactor Feedback for Visually Impaired 2006

I contributed to a team effort with Brian Self and Lynne Slivovsky to develop a device to aid visually impaired in navigating unknown environments using ultrasonic sensors to provide tactor feedback.

Roller Coaster Vibration Reduction 2006

Project supported by the Six Flags Corporation to reduce the noise emitted by rollercoasters and the track and support structures. Compared the effects of filling the track supporting structures with different damping materials. Measured noise and vibration levels in the field. Modeled the noise and vibration of track structures using finite element modeling and validated model with laboratory experiments.

Human Sensing 2006

Investigated a sensor system that meets the broad description of a human sensor while also meeting the specific applications of pre-crash detection, pedestrian safety and military sensing. The work consists of a literature search, sensor acquisition, sensor testing, and algorithm development. The project has been very successful meeting the stated objectives so far. Three sensors were identified as good candidates: ultrasonic, RADAR and LIDAR. Commercially available samples of each were acquired, instrumented and tested. Algorithms were developed to read the sensor raw data and compute telemetry data.

HCCI Engine Control System Development 2005

Worked in a team to develop an HCCI engine test stand incorporating an engine monitoring and control system.

Satellite Simulator Project 2005

Developed a star tracking hardware and control system on the Cal Poly Satellite Simulator. Supervised a senior project team to redesign the mechanical structure for the project.

A Semi-Active Helmholtz Resonator for an Acoustic Duct, Ph.D. topic. 1999

Developed active noise control technology to quiet tonal noise in ducted systems. Study used system modeling and identification to develop a controller design and implementation, sensor actuator instrumentation, analog/digital signal processing, and experimental proof of concept.

Manufacturing Research Consortium at Michigan State University (MRC) & Visteon Automotive. 1999

Industrial project with MRC and Visteon Automotive to develop active noise control for quieting industrial airborne noise in manufacturing environment. Included noise characterization, design of noise control solution, and experimental proof of concept, piezoceramic actuator control, controller design, and real-time digital signal processing.

Electro-Mechanical Acoustic Actuator for an Acoustic Duct, M.S. topic 1995

Included Bond Graph modeling theory, control design, analog/digital signal processing and real time control, and experimental acoustic measurements system to implement active noise control.

SEA Modeling Software Development 1995

Developed code in MATLAB environment for Statistical Energy Analysis (SEA) modeling tool "Engineering Acoustic Response" (EAR+) Software. Also developed database and data comparison procedures for SEA model results.

Publications

Accepted Reviewed Journal Publications

Birdsong, C., et. Al. "Student Acceptance of Online Textbooks across Multiple Engineering Courses,"
Advances in Engineering Education Journal, June, 2015

Davis, J., Birdsong, C., Cota, H., "Vibroacoustic Study of Circular Cylindrical Tubes Pertaining to Coaster Rails," Noise Control Eng. J. 59 (4), July-Aug 2011

Birdsong, C., and Radcliffe, C. J., 1999, "A Compensated Acoustic Actuator for Systems with Strong Dynamic Pressure Coupling," Journal of Vibrations and Acoustics, Vol. 121, pp. 89-94.

Reviewed Conference Publications

Roussel, S., Proumamilla, H., Birdsong, C., Schuster, P., Clark, C., "Enhanced Vehicle Identification Utilizing Sensor Fusion and Statistical Algorithms," IMECE2009-12012, November 13-19, 2009, Lake Buena Vista, Florida, USA

Chen, J., Victorino, C., Birdsong, C., Menon, U., "A Study of Online Textbook Use across Multiple Engineering Courses," ASEE Annual Meeting, Vancouver BC, June 2011

Self, B., Birdsong, C., "A New Spin on Teaching 3D Kinematics and Gyroscopic Motion," AC 2008-1437, ASEE Annual Meeting 2008

Birdsong, C., "Developing a MATLAB/Simulink RTWT Based Hydraulic Servo Control Design Experiment," American Society of Engineering Educators World Conference, Honolulu, Hawaii, June 2007

Desrosiers, D., Birdsong, C., Schuster, P., "Using the Pre-Crash Simulator to Develop a Vehicle Collision Prediction Algorithm," Fifth IFAC Symposium on Advances in Automotive Control, paper number AAC07-042, Monterey, California, August 2007

Birdsong, C.B., Schuster, P., "Research in the Undergraduate Environment," Paper Number 2006-1447, American Society for Engineering Educators, 2006 Annual Conference and Exhibition, Chicago, June 2006

Birdsong, C.B., Schuster, P., Carlin, J., Kawano, D., Thompson, W., "Test Methods and Results for Sensors in a Pre-Crash Detection System," Paper Number 06AE-19, SAE World Congress April 2006

Carlin, J., Birdsong, C.B., Schuster, P., Kawano, D., Thompson, W., "Evaluation of Cost Effective Sensor Combinations for a Vehicle Pre-Crash Detection System," SAE Commercial Vehicle Engineering Congress and Exhibition Nov, 2005

C. B. Birdsong, "An Integrated Measurement to Road Vibration Simulation System," The Engineering Integrity Society, Simulation, Test & Measurement Group Conference October, 2001, Birmingham, UK.

C. B. Birdsong, et. al. "A New Portable PC Driven Dynamic Signal Analyzer," 2001 SAE Noise & Vibration conference & Exposition, Traverse City, Michigan.

C. J. Radcliffe and C. B. Birdsong, "An Electronically Tunable Resonator for Noise Control," 2001 SAE Noise & Vibration conference & Exposition, Traverse City, Michigan.

Birdsong, C., and Radcliffe, C., 2000, "Comparison of Two Acoustic Actuators in a Semi-Active Helmholtz Resonator," 2000 ASME International Mechanical Engineering Congress and Exposition, Orlando, Florida, AD-Vol. 61, pp. 179-186.

Birdsong, C., and Radcliffe, C., 1997, "A Smart Helmholtz Resonator," International Mechanical Engineering Congress & Exposition, Active Noise Control - Work in Progress Conference, Dallas, Texas

Birdsong, C., and Radcliffe, C., 1997, "Development of a Comparison Index and a Database for Statistical Energy Analysis Model Results," SAE Noise and Vibrations Conference & Exposition, Traverse City, Michigan

Birdsong, C., Byam, B., and Radcliffe, C., "Software and Database Development for Statistical Energy Analysis Modeling Software," submitted to Institute of Automotive Engineering, Daewoo, Korea, 1996

Birdsong, C., Radcliffe, C., and Goenka, L., 1999, "Active Noise Control for Visteon Nozzle System," submitted to Visteon Automotive, ETC Division

Poster Sessions

"Truck Crash Avoidance Project," Birdsong, Schuster, Porumamilla, Roussel, et. al. Transportation Research Board 88th Annual Meeting, January, 2009, Washington, D.C

Magazine, Periodicals and Web Articles

"Undergraduate Engineers Develop Hydraulic Servo Control Systems Using Model-Based Design with Simulink," Birdsong, Mathworks Digest Academic Edition February 2009

C. B. Birdsong, et. al, "Focus on the job in hand. When USB 2.0 technology is employed in test and measurement signal analyzer hardware, life can become so much more simple," Testing Technology International Magazine, November 2002

Professional Associations

American Society of Engineering Educators, members since 2007

American Society of Mechanical Engineers, member 1990 – present; Vice President of San Luis Obispo Student Chapter, 1990-91; judge for ASME senior design projects at MSU 1996-99; consulted on MSU winning Mars Rover project which advanced to the national final competition, 1999

Tau Beta Pi, Secretary of San Luis Obispo Student Chapter, 1990-91 Student Chapter Advisor 2005-present.

Pi Tau Sigma, Secretary and founding member of San Luis Obispo Student Chapter 1990-91, Student Chapter Advisor 2005-present.

Professional Experience

DACTRON INC., Milpitas, California 4/00 – 12/02

Product Manager: Developed new digital signal analysis and vibration shaker control products including product specification, packaging, design, software, and user interface. Developed training and marketing material including user manuals, marketing material and technical papers. Administered customer and sales training seminars. Research and development of new technologies and methods. Provided support for customers in automotive, aerospace, electronics, military, independent laboratory, consulting industries.

TAMARHOFF ASSOCIATES, Alexandria, Virginia 2/94 – 7/94

Computer Instructor: Taught computer program use to a variety of professional personnel. Software included word processing, spreadsheet and database programs.

MACHINE DEVELOPMENT COMPANY INC., Dublin, California 5/93 – 9/93

Project Engineer - Machine design of custom automated packaging equipment, prepared assembly, detail, electrical schematics, and panel layout drawings on AUTOCAD, wrote operation manuals and programmed programmable logical controllers.

RADIAN CORPORATION Walnut Creek, California 7/91 – 5/93

Environmental Engineering Consultant - Managed \$2.5 million site cleanup project, supervised subcontractors, performed computer statistical analysis, budget preparation, regulation analysis, technical report writing and editing, and administered Novell network.

CAL POLY and BUCKNER IRRIGATION, San Luis Obispo, California 3/91 – 7/91

Senior Design - Designed automated manufacturing station for plastic sprinkler manufacturer in a team effort. Design involved pneumatic logic and precision sonic welding. Produced final analysis, report, and working drawings.

COMPUTER AIDED PRODUCTIVITY CENTER – CAL POLY, San Luis Obispo, California 3/89 – 7/91
Teaching Assistant - Assisted students in CADAM, CATIA, CAEDS, CBDS and several other CAD and engineering design related computer software packages.

APPLIED MAGNETICS, Goleta, California 8/88 – 3/89

Cad Drafting CO-OP - Designed and produced documentation for tooling in magnetic head production. Logged 800 hours on CADAM system. Designed a test stand for quality assurance.

DOW CHEMICAL, Walnut Creek, California 7/86 – 8/88

Engineer Intern (6/88 – 8/88) - Designed and constructed test stand for research and development gas separation modules involving computer controlled valve systems and data collection.

Lab Technician (7/86 – 9/87) - Designed and performed mechanical and environmental tests on R&D plastic optical fiber.