Mark M. Flynn

EDUCATION

Ph.D., Electrical and Computer Engineering, The University of Texas at Austin **2003**
- Dissertation: *A Methodology for Evaluating and Reducing Rotor Losses, Heating, and Operational Limitations of High-Speed Flywheel Batteries*

M.S., Electrical and Computer Engineering, The University of Texas at Austin **1999**
- Thesis: *Design, Construction, and Operation of a Low Distortion Pulse Width Modulation Inverter for Use in a Harmonic Testing Station*

B.S. with Honors, Electrical and Computer Engineering, The University of Texas at Austin **1997**

RESEARCH EXPERIENCE

Applied Research Laboratories, The University of Texas at Austin **2014 – Present**
Research Associate 2014 – Present

- **Naval Sea Systems Command – Sonar Development**
  May 2014 – Present
  Design of power-electronic and magnetic systems for high-performance naval applications including dc-dc converters, inverters, and actuators. Proficient in all aspects of product development including design, testing, and manufacturing support.

Center for Electromechanics, The University of Texas at Austin **1999 – 2014**
Research Associate 2010 – 2014
Research Engineer V 2008 – 2010
Research Engineer IV 2004 – 2008
Research Engineer III 2001 – 2003
Research Engineer II 1999 – 2001

- **U.S. Army Construction Engineering Research Laboratory – Forward Operating Base In-The-Loop Power System Simulator**
  August 2013 – April 2014
  Developed a simulator-in-the loop for forward operating bases designed to enhance existing supervisory control and data acquisition (SCADA) systems by automatically and continuously simulating credible contingencies and anticipating system state before the SCADA system commits a system change. The in-the-loop simulator is also capable of suggesting efficiency and reliability improvements by computing numerous system metrics among others such as power loss, line outage distribution factors, energy storage requirements, and historical usage data.

- **Office of Naval Research – DC Ship Microgrid Demonstrations**
  April 2013 – April 2014
  Developed highly detailed Simulink models of multi-megawatt-level naval ship electric power systems to aid in the design and verification of subsequent physical tests. Assisted with design and operation of physical tests representing naval power systems.

  Created a mobile single- and 3-phase power supply capable of producing 400 A sinusoidal currents from any available 480 V mains outlet to facilitate the high-precision, detailed measurements of two three-phase transformers rated at a nominal 1.212 and 0.89 MVA

respectively. The 27 parameters measured or computed for each transformer were used to create detailed Simulink models significantly improving accurate prediction of microgrid performance. Performed analytical steady state and transient solutions of the expected short-circuit current on an 1100 V dc bus of the CEM microgrid to determine the effects on source-side components. The calculations take into account an upstream three-phase diode rectifier and two three-phase transformers rated at 1.5 and 1.212 MVA respectively. Analytical results were compared to simulations in Simulink with excellent agreement. Multiple options were calculated to reduce the short-circuit current during the application of a controlled short-circuit test to ensure the survivability of upstream components.

- **Pecan Street Inc. – Transformer Studies**
  March 2013 – August 2013
  Studied impact of residentially-sourced-electric-utility harmonics on distribution transformers. Analysis determined that harmonic generating loads within residences have little effect on voltage harmonics at the distribution transformer due to the low impedance of the transformer. Ultimately it was determined that the expense of instrumentation for monitoring the transformer voltage harmonics could be eliminated since voltage harmonic generation was negligible.

- **CODA Energy – 60 kW Multiphase Interleaved Bi-Directional DC-DC Converter and Controller Development**
  December 2011 – February 2013
  Principle investigator (project manager) for development of a 60 kW, 850-700 V to 410-220 V, 3-phase, interleaved bi-directional dc-dc converter and controller with low ripple voltage (< 0.2 %). Performed detailed converter design and developed a custom TMS320F28335 DSP-based controller including all software and interface hardware complete with a 422 component multilayer circuit board. The controller supports 16 analog input channels, multiple communications channels including CAN and Modbus, 31 digital I/O channels, as well as numerous supervisory and converter control functions. Conducted bi-directional power testing to validate converter and controller design and build. Developed a graphical user interface in Visual Basic to operate the converter.

- **Office of Naval Research – Medium Voltage DC Distribution and Fault Management Study**
  October 2011 – December 2011
  Researched and published a report providing an overview of MVDC distribution challenges and techniques with regard to fault mitigation including a review of commercially available MVDC motor drive systems. This report provided ONR's Electric Ship Research and Design Consortium a basis for determining under what conditions dc breakers are required when using shipboard MVDC distribution.

- **Open Algae – 1.5 MW Unipolar Pulsed Power Supply for Algae Lysing**
  September 2010 – October 2011
  Designed, built, and tested a 2.2 kV, 6.5 kW (1.5 MW pk) pulsed power supply for lysing (opening) algae cells in a more effective and more efficient manner than available with present technologies. Invented a novel method of seriesing multiple IGBTs resulting in a switch rating of 3.6 kV, 900 A with turn-on-and-off times of 400 ns. Developed a custom TMS32028F335 DSP-based controller which is able to adjust lysing performance based on algae variations. The user interfaces with the power supply via a custom programmed LCD touch screen. Performed all aspects of electrical design and assembly including power electronics, controller, user interface, 480 V mains interface, and power distribution and fault management. Performed 3-phase mains

input transformer specification and modeling including harmonic impact. Selected 480 V genset for mobile applications.

- **Vycon, Inc. – Research and Development Support**
  May 2010 – February 2012
  Continued support of research and development efforts regarding advanced high-speed flywheel motor and system controls. Computed changes to flywheel PMSM motor and power electronics to enable conversion of standard 125 kW flywheel system to a 347 kW version.

- **ExxonMobil Corporation – 2 MW Medium Voltage Undersea Inverter Design**
  June 2010 – November 2010
  Designed a 2 MW, 3-phase, 3-level NPC inverter which operates from a 5.6 kV dc link at hydrostatic pressures of 300 (4350 psi) bar. Developed detailed transient and steady state thermal models which accurately describe the thermal performance of the prototype inverter in a subsea environment. Evaluated and selected most optimal inverter topology for customer requirements and provided a long range vision for operation at increased dc voltage levels up to 150 kV. Designed a plan to test critical inverter components with suspected susceptibility to increased hydrostatic pressures.

- **ExxonMobil Corporation – Undersea Exposed High Pressure IGBT-Based Inverter Development and Testing**
  November 2009 – March 2010, June 2010 – June 2011
  Designed, built, and tested an MC689S12C32 microcontroller-based circuit board enabling the real-time online measurement of IGBT junction temperatures in an operational inverter with dc link voltages up to 1000 V. The analog junction temperature measurements are digitized by a 12-bit A/D converter and transmitted through a 2.5 kV isolation barrier to the microcontroller and then ultimately to a remote data collection system via an RS-485 link. The circuit board automatically synchronizes the measuring and reporting of junction temperatures to the interval of the IGBT gating signal which ensures optimal measurement accuracy. The capabilities of the measurement circuit are further enhanced due to its verified ability to operate in environments of elevated hydrostatic pressures up to 300 bar (4350 psi). The custom microcontroller software computes a "state of health" indicator for each IGBT being measured which allows IGBT replacement to be scheduled at an opportune time thereby avoiding expensive downtimes due to failures.

  Designed a test plan that enables the prediction of IGBT failures in-situ related to the effects of the increased hydrostatic pressure and added temperature variances.

- **Office of Naval Research – 1 MW Medium Voltage Series Fault Generator**
  October 2009 – June 2010
  Designed, built, and tested a series fault generation fixture and controller for a 1 kV, 1 kA dc microgrid. The fixture is designed to simulate a dc conductor break and operate with an arcing current up to 1000 A. The arc length is adjustable via a stepper motor and ball screw mechanism under the command of a custom MC689S12C32-microcontroller-based control board. The gap can be opened up to two inches via electric actuation with a 0.016" nominal gap distance resolution or a high-resolution capability of 0.0002" when desired. Pneumatic actuators are also employed allowing the arc gap to open beyond eight inches as well as at comparatively higher speeds. A custom Visual Basic-based GUI was developed to allow for automated control of the arc distance, opening rate, dwell time, and data capture.

- **Office of Naval Research – Matlab-Based Graphical User Interface for Simulink Control**
  October 2009 – December 2009
  Created a graphical user interface (GUI) in Matlab to operate a very large scale Simulink simulation model (5 day simulation time). The GUI allows for unskilled users to modify all aspects of the Simulink model and plot results in real time via an easy to use, single-window graphical interface. The adaptive design of the GUI allows it to respond to updates or modifications to the model without user intervention.

- **Science Applications International Corp. and Organic Fuels Algae Technology – 400 kW Algae Lysing Bipolar Marx Generator**
  March 2009 – November 2009
  Designed, simulated, and built a 1 kV, 400 A solid-state bipolar Marx generator for the lysing of algal cells via rapidly changing electric fields. The Marx generator was shown to improve the lysing of algal cells as compared to traditional techniques. Due to its highly configurable pulse width and amplitude capabilities it has served as an advanced test bed for biologists investigating algal cell behavior in the presence of electric fields.

- **TECO Westinghouse – Hybrid Vehicle Induction Motor Controller**
  July 2008 – September 2008
  Developed a TMS320F28335 DSP-based embedded controller for an advanced 75 kW, 5,000 r/min induction motor for a hybrid electric car. The controller utilized indirect field-oriented control and implemented a CAN 2.0B communications protocol for data transfer with other vehicle systems.

- **U.S. Department of Transportation and the Center for Technology and the Environment – Modeling and Performance Testing of a Fuel Cell-Battery Hybrid Shuttle Bus**
  September 2006 – September 2007
  Modeled and analyzed a PEM fuel cell-battery hybrid shuttle bus over a series of simulated routes in preparation for operation of actual bus. Obtained actual fuel cell bus – the first hydrogen fueled vehicle in the State of Texas – and began performance testing. Designed a high-speed flywheel system to replace the shuttle bus' chemical battery packs. Simulation results indicated 25 % improvement in fuel economy with a simultaneous 48 % increase in acceleration for modified fuel cell-flywheel shuttle bus compared to actual fuel cell-battery shuttle bus.

- **Vycon, Inc. – Rubber-Tired Gantry Crane Flywheel Controls Development and Consulting**
  February 2006 – March 2009, September 2009 – October 2009
  Developed the control methodology and software to convert 40-60 ton, diesel-powered rubber-tired gantry cranes (RTGs) into hybrid vehicles using a pair of high-speed flywheels for energy storage. The software enables the use of a smaller, $20 k cheaper diesel engine while simultaneously reducing RTG fuel consumption by more than 35 %. Provided on-site engineering and business consulting in numerous countries including Japan, South Korea and China; as well as locations in the U.S.

- **Office of Naval Research – All-Electric Ship Power System Development and Simulation**
  November 2003 – September 2004
  Developed a highly detailed proposed power system model including electromagnetic weaponry of an all-electric DDX type naval destroyer. Realistic and detailed models of components such as active filters, 40 MW motor drives, turbines, and rail gun systems were among those designed in a Simulink-based environment. The system model provided ship designers a means to perform a

robust analysis of the ship's electric systems performance and adaptability during a hostile engagement, especially in the event of sustained damage.

- **Vycon, Inc. – Custom High-Speed Motor Controller and Consulting**
  July 2003 – November 2007
  Created a custom TMS320LF2407A-based embedded high-speed PMSM motor controller including all hardware and software for use with permanent magnet synchronous machines up to 300 kW and 36,000 r/min. Integrated controller and motor components with three-phase power electronics to form an Uninterruptible Power Supply (UPS) with flywheel energy storage. Created software to allow the addition of chemical batteries as well as multiple flywheels in parallel. Developed a custom graphical user interface for operator control and diagnostics of the UPS system. Provided on-site engineering and business consulting in numerous countries including Japan and New Zealand, as well as locations in the U.S. Assisted with the development of an additional controller based on the TMS320F2812 processor.

- **Defense Advanced Research Projects Agency – Transcranial Magnetic Stimulator Power Supply**
  March 2003 – June 2003
  Designed and tested two high-frequency, mobile, pulsed power supply topologies used to actuate a Transcranial Magnetic Stimulator. Both supplies were controlled via an MC68HC11 microcontroller. The first power supply was transistor-based (IGBT) and provided 800 A at 4,000 V for sub millisecond intervals. A second, resonant thyristor-based (IGCT) supply was created with improved efficiency for 6,500 A, 2,000 V operation for sub millisecond intervals. Each supply enabled deep cranial stimulation while achieving both small weight and volume.

- **Office of Naval Research – 20 MW Electric Motor Drive**
  October 2002 – May 2003
  Designed and simulated the entire power electronics portion of a 20 MW naval hybrid-electric motor drive. Evaluated multiple options for the drive's main inverter including multilevel, isolated H-bridge, and series pulse width modulation, resonant and cycloconverter topologies. Worked with a team of engineers to design the remainder of the hybrid drive-train including the generator, power electronics, and motor.

- **Western Geophysical – Mobile 3.2 MVA Inverter-Based Geological Shaking System**
  February 2002 – November 2002
  Designed a low distortion 3.2 MVA, single phase inverter rated for 7,000 A peak currents with a continuous 1,600 A dc current as part of a mobile electromagnetic vibration system for oil-field exploration. Researched and specified the inverter's mobile power supply consisting of a diesel engine, self-exciting generator, input and output filters, as well as the inverter control system. Performed Simulink, Matlab, and PSPICE simulations for the entire system. A subscale unit was also designed.

- **Federal Railroad Administration – Magnetic Bearing Sensor Circuit Development**
  February 2002 – April 2002
  Designed and built an advanced 13-channel magnetic bearing sensor conditioning circuit board to process the speed sensor and the x-, y-, and z-axis channels for the magnetic bearings of a 4 MW, 15,000 r/min locomotive-based flywheel. The circuit board is notable for being the first printed circuit board designed at the Center for Electromechanics to use surface mount technology which enabled it to achieve 13 differential inputs and 19 differential outputs all with low noise and high common mode rejection on a 24 square inch circuit board.

- **NASA Glenn Research Center – International Space Station Flywheel Battery Controller**
  March 2001 – April 2002
  Created a custom TMS320LF2407A DSP-based embedded high-speed PMSM motor controller including all hardware and software for use with a 3.6 kW, 53,000 r/min flywheel battery for use on the International Space Station. Selected all power electronic components to enable laboratory testing. Performed detailed motor loss calculations due to power electronics and motor controller operation.

- **Houston Metropolitan Transit Authority – Urban Transit Bus Flywheel Battery Controller**
  September 1999 – February 2001, May 2002 – October 2002
  Created a custom TMS320LF2407 DSP-based embedded motor controller including circuit boards and software. Integrated a 150 kW, 40,000 r/min flywheel battery into the hybrid-electric drive-train of an urban transit bus. Developed control software to operate the flywheel motor and to interface with the bus' power train. Successfully demonstrated 100 % improvement in vehicle acceleration with a simultaneous 25 % reduction in power required from the engine, and energy recovery while braking during road tests.

TECHNICAL SKILLS

Power Electronics

- Power electronic circuit design, simulation, and construction up to several kV and kA
  - Continuous duty: inverters, rectifiers (passive/active), motor drives, dc-dc converters
  - Pulsed duty: high power switches, Marx generators
- Motor control design and implementation for DC, PMSM, induction, and stepper motors

Electronics and Controllers

- Analog, digital, mixed-signal circuit design, simulation, printed circuit layout, and assembly
- Embedded DSP/microcontroller design, layout, and software programming
- Digital signal processing: DFT's, IIR and FIR filters, averaging, sampling, anti-aliasing, fixed-/floating-point
- Protocol proficiencies: CAN, SPI, Modbus TCP/RTU, RS-232/422/485, I^2C. Familiar with Ethernet, TCP/IP.
- Design and programming of graphical user interfaces
- Soldering/rework of through-hole and surface mount components (SOIC, TSSOP, LQFP etc.)

Electric Power Systems

- Design and specification of power system components for vehicular and industrial applications
- Proficient in harmonic and transient studies, fault mitigation, load flow analysis, energy storage evaluations

Embedded Processors

- All aspects of processor proficiency (e.g. hardware/software/board layout) with: BASIC Stamp, MC68000, MC68HC11, MC68HC12, MC689S12, TMS320C31, TMS320LF2407A, TMS320F28335, TMS320F28055. Familiar with TMS320F2812, PIC, and Raspberry PI.

Magnetics

- Design and analysis of inductors and transformers for power electronic applications
- Design and analysis of magnetic actuators; magnetic analysis of rotating machines

Physical System Modeling

- Proficient in the modeling, simulation, and analysis of electrical, magnetic, mechanical, and thermal systems

Computer Skills

- Programming Languages: C, assembly (several processors), BASIC, Visual Basic, Pascal

- Analysis Tools: Matlab, Simulink, Stateflow, Power System Analysis Toolkit, Igor Pro
- Software Development Tools: Code Composer Studio, ICC11, ICC12, NoICE12
- Schematic Capture and/or Layout: OrCAD, PADS, Eagle CAD, Design Works, ExpressPCB
- Circuit Simulation: PSpice, LTspice, ICAP/4
- 3D Modeling: SolidWorks, Sketchup
- Finite Element Analysis Tools: COMSOL Multiphysics, COSMOS/m
- Drawing Tools: Visio, Blueprint PCB
- Automation Tools: Familiar with LabVIEW

Test and Measurement

- Adept with various instruments including: oscilloscopes, spectrum analyzers, function generators, multimeters, power analyzers, hipot testers, logic analyzers, impedance analyzers, network analyzers, partial discharge testers, etc.

JOURNAL AND MAGAZINE PUBLICATIONS

Sungwoo Bae, Kwasinski, A., Flynn, M. M., Hebner, R. E.; "High-Power Pulse Generator With Flexible Output Pattern," *Power Electronics, IEEE Transactions on*, vol.25, no.7, pp.1675-1684, July 2010.

M. M. Flynn, P. McMullen, O. Solis, "Saving Energy Using Flywheels," *IEEE Industry Applications Magazine*, vol. 14, no. 6, pp. 69-76, Nov./Dec. 2008.

M. M. Flynn, J. J. Zierer, R. C. Thompson, "Performance Testing of a Vehicular Flywheel Energy System," *SAE 2005 Transactions Journal of Passenger Cars – Mechanical Systems,* vol. 114, pp. 119-126, February 2006.

REFEREED CONFERENCE PUBLICATIONS

S. Pish, J. Herbst, D. Wardell, A. Gattozzi and M. Flynn, "Power Management and Energy Storage experiments on a MW-scale naval power system test-bed," *Electric Ship Technologies Symposium (ESTS), 2015 IEEE*, Alexandria, VA, 2015, pp. 453-458.

M. M. Flynn, C. S. Hearn, M. C. Lewis, R. C. Thompson, R. G. Longoria, "Prime Mover and Energy Storage Considerations for a Hydrogen-Powered Series Hybrid Shuttle Bus," *Proceedings of the IEEE Vehicular Power and Propulsion Conference*, Sept. 9-12, 2007.

C. S. Hearn, M. M. Flynn, M. C. Lewis, R. C. Thompson, R. G. Longoria, "Low Cost Flywheel Energy Storage for a Fuel Cell Powered Transit Bus," *Proceedings of the IEEE Vehicular Power and Propulsion Conference*, Sept. 9-12, 2007.

M. M. Flynn, P. McMullen, O. Solis, **"**High-Speed Flywheel and Motor Drive Operation for Energy Recovery in a Mobile Gantry Crane," *Proceedings of the IEEE Applied Power Electronics Conference*, Anaheim, CA, Feb. 25 – March 1, 2007.

M. M. Flynn, A. Paylan, "A Novel High-Speed Flywheel Based DC Voltage Source with Soft Handover Capability," *Proceedings of the IEEE International Electric Machines and Drives Conference*, San Antonio, TX, May 15-18, 2005.

M. M. Flynn, J. J. Zierer, R. C. Thompson, "Performance Testing of a Vehicular Flywheel Energy System," SAE World Congress, Detroit, MI, April 11-14, 2005.

J. Beno, M. Flynn, R. Hayes, R. Hebner, J. R. Jackson, A. Ouroua, M. Pichot, E. Schroeder, J. Zierer, and D. Weeks, "Design and Analysis of a 20 MW Propulsion Power Train," *Proceedings of the 7th International Naval Engineering Conference and Exhibition (INEC 2004)*, March 16-18, 2004, Amsterdam, The Netherlands.

R. J. Hayes, D. A. Weeks, M. M. Flynn, J. H. Beno, A. M. Guenin, J. J. Zierer, and T. Stifflemire, "Design and Performance Testing of an Advanced Integrated Power System with Flywheel Energy Storage," in the SAE International *Proceedings of the Future Transportation Technology Conference*, Costa Mesa, CA, June 23-25, 2003.

L. A. Hawkins and M. Flynn, "Influence of Control Strategy on Measured Actuator Power Consumption in an Energy Storage Flywheel with Magnetic Bearings," in the *Proceedings of the 6th International Symposium on Magnetic Suspension Technology*, Turin, Italy, 2001.

NON-REFEREED PAPERS

J. Beno, A. Ouroua, M. Flynn, "Effects of EM Weapons Requirements on the Electric Ship Power System," IMAREST Engine as a Weapon Symposium, Bristol, UK, June 9-10 2004.

E. Schroeder, M. A. Pichot, A. Ouroua, M. M. Flynn, and J. H. Beno, "Development of Electric Propulsion Motors with Integrated Power Electronics," Electric Machine Technology Symposium 2004 (EMTS 2004), Philadelphia, PA, January 27-29, 2004

REPORTS

M.M. Flynn, C.E. Penney, "Phase I Final Report for DC-DC Converter Controller Development," Final report submitted to CODA Energy, RF 335, December 2012.

M.M. Flynn, "DC-DC Converter Stack Sizing Recommendations and Tradeoffs," Final Design Technical Report submitted to CODA Energy, RF 326, February 2012.

J.D. Herbst, H-P. Liu, M.M. Flynn, and D.R. Wardell, "IGBT Viability Study," Final Technical Report submitted to ExxonMobil Upstream Research Company, RF 300, November 2011.

J.D. Herbst, A. Gattozzi, and M.M. Flynn, "Medium Voltage DC Inverter Design," submitted to ExxonMobil Upstream Research Company, Offshore, Arctic, and Pipelines Division, January 2011.

R.F. Hebner, R. Pearsall, M. Poenie, R. Connelly, M. Fountain, M.D. Werst, M. Flynn, S. Bae, A. Williams, "Status report: Algae Lysing," submitted to SAIC, RO 268, March 2009.

R.F. Thompson, C.S. Hearn, M.C. Lewis, M.M. Flynn, "Flywheel Technology Program," Final report submitted to Center for Transportation and the Environment, RF 267.1, October 2008.

R.F. Thompson, C.S. Hearn, M.C. Lewis, M.M. Flynn, "Heavy Hybrid Vehicles Technology Program," Final report submitted to U.S. Department of Transportation and Federal Transit Administration, RF 277, October 2008.

J.H. Beno, J. Zierer, A. Ouroua, E. Schroeder, M. Flynn, D. Weeks, M. Pichot, D. Bogard, K. Davey, and R. Hebner, "Baseline prime power system used by The University of Texas at Austin," Technical report for program funded by the Office of Naval Research as part of the Electric Ship Research and Development Consortium, RO 245, March 2003.

R.J. Hayes, J.H. Beno, M.M. Flynn, D.A. Weeks, J.J. Zierer, "RA-98 Flywheel System Integration," Final report to SCAT – DOT Containment 2000, Contract # MDA972-94-2-0003, 2002.

D.A. Weeks, R.J. Hayes, J.J. Zierer, M.M. Flynn, J.H. Beno, T. Stifflemire, "RA-99 Demonstration of Advanced Components on the ATTB," Final report to DARPA and SCATT, Contract #MDA972-94-2-0003, 2002.

R.J. Hayes, J.H. Beno, J.J. Zierer, D.A. Weeks, M.M. Flynn, "Houston Metro ATTB Program," Final report to Houston Metro, 2002.

INVITED TALKS AND SEMINARS

Seminar, "Introduction to Power Electronic Energy Conversion," Power Electronics Workshop hosted by National Instruments and the Center for Electromechanics, Austin, TX June 12, 2016.
Invited Talk, "Technology Development for Automated Component Identification in Microgrids," Microgrid RODEO (Research on Distributed Electricity Operations) Summit, Austin, TX February 20-21, 2014.
Seminar, "Power Electronic Energy Conversion Applications and Commonly used Converter Topologies," presented to 3M Corporation at the Center for Electromechanics, Austin, TX September 27, 2013.
Seminar, "Power Electronics Thermal Management," presented to 3M Corporation at the Center for Electromechanics, Austin, TX March 8, 2013.
Invited Talk and Panel Discussion, "High-Power Energy Storage for a Hydrogen Fuel Cell Transit Bus," 10th Anniversary Transportation Summit, Irving, TX, August 7-10, 2007.
Invited Talk, "Consider Every Option! (CEO!)," a day-long seminar sponsored by the Women in Engineering Program at the University of Texas at Austin illustrating the challenges and opportunities encountered in electrical engineering. Directed towards graduating high school females in an attempt to increase enrollment of this historically underrepresented demographic in electrical engineering. Presented six times during 1997 – 1999.

TECHNICAL ADVISORY PANELS

Seminar, "Power Electronics Development," Center for Electromechanics Advisory Panel Discussion, Austin, TX, December 4, 2012.
Seminar, "Power Electronics Highlights at the Center for Electromechanics," Center for Electromechanics Advisory Panel Discussion, Austin, TX, November 1, 2005.
Seminar, "Power Source for Transcranial Magnetic Stimulation Experiments," Center for Electromechanics Advisory Panel Discussion, Austin, TX, October 7, 2003.

PRESS ARTICLES

N. Canter, "Flywheels: Improving Energy Efficiency," *Tribology and Lubrication Technology*, pp. 12-13, July 2009.

D. Bonn, "New Prototype Bus Completed," *The Daily Texan*, September 16, 2002.

COMMERCIALLY LICENSED TECHNOLOGY

- Exclusive license of bipolar flyback power supply technology granted to Organic Fuels Algae Technologies, LLC, Feb. 2010.
- Exclusive license of bipolar solid-state Marx generator technology granted to Organic Fuels Algae Technologies, LLC, Feb. 2010.
- Exclusive commercial license of high-speed motor control software to Vycon, Inc. and Direct Drive Systems, Inc. for 6 years granted September 2006.
- Commercially licensed high-speed motor control software technology to Vycon, Inc., 4 year exclusive license for terrestrial applications granted September 2003.

FILED RECORDS OF INVENTION

- "OFAT-1 Unipolar Power Supply Software," Robert E. Hebner, Mark M. Flynn, UTID 6228 FLY, submitted November 2012.
- "DC-DC Converter Control Software," Mark M. Flynn, UTID 6215 FLY, submitted Oct. 2012.
- "High-Reliability, High Efficiency, IGBT Series Sharing Circuit," Robert E. Hebner, Mark M. Flynn, Robert V. Pearsall, Mike D. Werst, UTID 6189 HEB, submitted Aug. 2012.
- "Vce monitor," John D. Herbst, Mark M. Flynn, UTID 6023-HER, submitted Aug. 2011.
- "Bipolar flyback power supply," Robert E. Hebner, Mark M. Flynn, Mike D. Werst, UTID 5718-HEB submitted Nov. 2009.
- "Bipolar solid-state Marx generator," Alexis Kwasinski, Sung Woo Bae, Mark M. Flynn, Robert E. Hebner, Mike D. Werst, Siddharth B. Pratap, Aaron S. Williams, UTID 5679-KWA, submitted August 2009.
- "Flywheel energy storage for passenger vehicles, trucks, and buses," Richard C. Thompson, Robert E. Hebner, Brian T. Murphy, Joseph H. Beno, John D. Herbst, Richard J. Hayes, Mark M. Flynn, Clay S. Hearn, Mike C. Lewis, UTID 5540-THO, submitted Oct. 2008.
- "Flywheel motor generator with power electronics for the formula one kinetic energy recovery system," Richard C. Thompson, Hamid Ouroua, Richard J. Hayes, Brian T. Murphy, Stephen M. Manifold, Mark M. Flynn, Clay S. Hearn, UTID 5260-THO, submitted March 2007.
- "Novel Motor Heating Reduction Filter for Use with Rotating Electrical Machines," Mark Flynn, Antranik Paylan, UTID 5039 FLY, submitted June 2005.
- "Magnetic stimulators using IGCT switching devices," Kent R. Davey, Mark M. Flynn, UTID 2850-DAV, submitted Feb. 2004.
- "High Speed Motor Controller," Richard J. Hayes, Mark M. Flynn, UTID 2777-HAY, submitted July 2003.

TEACHING EXPERIENCE

Electrical and Computer Engineering Dept., The University of Texas at Austin

- **Lecturer**
  - Electric Machines and Drives (EE 341 / EE394.13): Spring 2019, Fall 2017, Spring 2016, Spring 2015
  - Power Systems Engineering (EE 369): Spring 2014
  - Power Electronics (EE 462L / EE 394.7): Spring 2019, Fall 2018, Spring 2018, Fall 2017, Spring 2017, Fall 2016, Spring 2016, Fall 2015, Spring 2015, Fall 2014, Fall 2013
  - Introduction to Electrical and Computer Engineering (EE 302): Fall 2008, 2007, 2006
  - Electric Circuits, Electronics, and Machines (EE 331): Fall 2005

- **Departmental Committee Assignments**
  - Member, Department of ECE Core Course Committee August – December 2018
    Tasked with planning a modern approach to the common core ECE curriculum
- **Graduate Student Research Supervision**
  - Ph.D. Defense Committees: Qingyun Huang (Summer 2018)
  - Ph.D. Qualifying Committees: Qingyun Huang (Spring 2018), Hunter Estes (Spring 2016), Joel Campbell (Spring 2009)
  - M.S. Thesis Committee: Oriana Wong (Summer 2018)
- **Faculty Supervisor for Undergraduate Research Fellowship**
  - Supervised undergraduate researcher Jesus Rendon in the development of a motorized intelligent exercise machine, 2014
- **Undergraduate Senior-Design Faculty Advisor**
  - **EE 364D, EE 464K** **Fall 2018 – Spring 2019**
    DC Motor Boosterpack and Cape : Bennett Treadwell, Bryce Cotner, Summer Gregurek, Robert Whitlatch,
  - **EE 464R** **Spring 2018**
    Development of Motorized Shoes Operated by Remote Control : Ali Momin, Raphael De Los Santos, Zain Modi, Quinn Zambeck, Robin Dhakal
  - **EE 464S, EE 364E** **Fall 2013 – Spring 2014**
    Development of Electricity-Producing Shoes to Recharge Cell Phones: Darla Hollander, Kristopher Williams, Rory Tatum, Melinda Haghighatian,
- **Student Organization Activities**
  - **Electrical Systems Advisor for Longhorn Racing Electric** **2016-2017**
    Longhorn Racing Electric is UT Austin's Formula SAE (electric division) student racing team and is part of student chapter of the Society of Automotive Engineers at UT Austin.
  - **UT-Austin Student IEEE Power Engineering Society Seminars** **2014, 2016**
    Talks regarding on-going and previously conducted power-related research
  - **Faculty Advisor for Eta Kappa Nu (HKN)** **2013-Present**
    HKN is an honor society within the Electrical and Computer Engineering Department.

Applied Research Laboratories, The University of Texas at Austin

- **Intern Supervisor** for numerous students from the Electrical and Computer Engineering Dept. at the University of Texas at Austin, 2015 – 2019.

Center for Electromechanics, The University of Texas at Austin

- **Co-Op Supervisor** for six students from the Electrical and Computer Engineering Dept. at the University of Texas at Austin, 2001 – 2009.
- **Technical Advisor** for senior design student teams from the Mechanical Engineering Dept. at the University of Texas at Austin, Spring 2001, Fall 2001.
- **Organized tours and discussions for ECE freshmen** of the Center for Electromechanics enrolled in EE 302 Introduction to Electrical and Computer Engineering in the Electrical and Computer Engineering Dept. at the University of Texas at Austin to highlight study and career opportunities in fields associated with power electronics and electromechanics. Presented 4 times during 2001 – 2002.

HONORS AND AWARDS

- 2018 Gordon T. Lepley IV Endowed Memorial Teaching Award for excellence in teaching presented by the Department of Electrical and Computer Engineering at the University of Texas at Austin.
- 2018 Fourth-Year Student's Choice Award for Excellence in Teaching presented by the ECE Undergraduate Advisory Board at the University of Texas at Austin.
- 2017 Fourth-Year Student's Choice Award for Excellence in Teaching presented by the ECE Undergraduate Advisory Board at the University of Texas at Austin.
- 2014 Awarded commemorative clock from the staff of Services for Students with Disabilities at the University of Texas at Austin following student nomination for being "someone who has offered support and guidance to students with disabilities".
- 2009 Second place IEEE *Industry Applications Society Magazin*e paper of the year for article entitled, "High-Speed Flywheel and Motor Drive Operation for Energy Recovery in a Mobile Gantry Crane".