

# CONTINUING EDUCATION OPPORTUNITIES

The 2006 IAS Annual Meeting will offer a number of continuing education opportunities during the week of October 8-12, 2006 in Tampa, Florida. This is your preliminary information regarding the upcoming opportunities that are available. Because the final offerings are dependent on registered attendance, it is important that you sign up in advance. Registration for one or more of these courses can be independent from the technical conference—you need not participate in the conference in order to gain access to these continuing education opportunities. Registration for these continuing education courses and the conference, including social activities for companions and discounted hotel rates, will be available via the conference web site approximately May 1, 2006. Registration fees for these courses have not been finalized at this time, but they will be in the range of US\$100-US\$200 per course. Different courses will be offered throughout the week, so pick out the technical area you are interested in and join us at the event!

## **Sunday, October 8: *Application-Driven Design and Control of Brushless Permanent Magnet Motors* (4 hours in length)**

**Organizer:** Mehdi Abolhassani, Black & Decker Corp.

The increasing rate of depletion of fossil energy resources on one hand and growing energy cost and demand on the other hand has initiated considerable research activities worldwide to explore means for tapping into high efficiency motor/drive technologies. Replacing direct current (DC) machines and alternating current (AC) induction machines with permanent magnet (PM) machines has recently gained great interest in appliance, automotive, medical, aerospace and military industries. This course has been organized to address the state-of-the-art of application-oriented practical key issues in the areas of design, analysis, tools, and drive control methods of PM machines. In this course, design requirements and analysis approaches of combined motor and drive system in a wide variety of applications in home appliances, automotive, aerospace, and industry use have been carefully developed and practical and manufacturing issues are discussed. Also, practical implementation of digital control method of variable speed PM motor drives are offered.

## **Sunday, October 8: *State of the Art Motor Manufacturing Practices: Impact on Design and Analysis* (4 hours in length)**

**COURSE HAS BEEN WITHDRAWN**

## **Sunday October 8: *Advanced Modeling, Control and Optimization Techniques for Industrial Automation* (4 hours in length)**

**Organizer:** Ganesh K. Venayagamoorthy, University of Missouri-Rolla

This course will present background information on the state of art control in industry using proportional integral control (PID) and draw the need for better controls. Advanced controls using fuzzy logic, self-tuning PID controllers and neural networks will be presented. The advantages of advanced controls will be illustrated on a number of industrial applications including motor control, generator control and process control. Background information on classical optimization techniques

will be covered. Evolutionary and Swarm based optimization techniques applicable to industrial processes and controls will be presented. The design of optimal PID controllers using evolutionary and swarm techniques will be presented. The course will cover hardware implementations platforms for advanced techniques such as DSPs, microcontrollers.

## **Sunday October 8: *Design and Control of Interior Permanent Magnet Motor Drives* (4 hours in length)**

**Organizer:** M. F. Rahman, University of New South Wales, Australia

Interior Permanent Magnet (IPM) motors are now being used in a very wide variety of applications ranging in capacity from a few hundred watts to multi-megawatts. Such motors are destined to be the choice for automotive propulsion. The course will cover the analysis, design and control of the Interior Permanent Magnet machines. It will start with a review of the background of brushless DC motor and the comparative advantage of the IPM motor will be brought out. Design of the magnetic circuits and windings for specific performance will be covered. Control of the IPM motor with PWM current controller in the stator and rotor reference frames will then be covered. Control modes or trajectories with specified performance in terms of torque, field weakening and input power factor will be included. Control techniques of the IPM motor with and without a mechanical shaft sensor will also be covered.

## **Sunday October 8: *Power Converters for Utility Applications* (8 hours in length)**

**Organizer:** Subhashish Bhattacharya, North Carolina State University

This course is focused on addressing both existing and cutting edge developments in high power converters suited for various utility applications. All aspects of high power converters - such as semiconductor devices, converter topologies and design, converter controls and protection, will be covered. Converter specifications will be derived from various utility applications - such as, active filters, STATCOM, DVR, UPQC (Unified Power Quality Conditioner). System level issues of power converters for utility applications will be enumerated through a case study.

**Sunday October 8: The Impact of the European CE Marking Requirements on Design and Performance of Power Converters and Electrical Drives** (4 hours in length)

**Organizer:** Ralph M. Kennel, Wuppertal University

The goal of this course is to provide some background to the goals and design procedures of these directives and to avoid disadvantageous decisions and solutions even before any CE expert is involved in launching a product to the European market. This course is not presented by a lawyer or a commercial consultant, but by a development engineer, who had to cope with European Directives when designing inverters and servo drives.

**Sunday October 8: Matching Drive Solutions to Industrial Control Applications** (8 hours in length)

**Organizer:** Brian Boulter, ApICS LLC

This course will concentrate on identifying an appropriate drive solution for a given control loop in the most commonly encountered applications in industrial systems. Emphasis will be placed on the selection of the best drive solution for a given control loop in a given application. Topical discussions will include basic control theory for speed loops, position loops, tension/torque loops, and pressure loops. The discussions will include both feed-back and feed-forward techniques. Application bandwidth requirements will also be discussed, and a method for selecting the best drive type (including tips on what to expect from various drive vendors) will be covered. In addition, the currently available software design packages will be discussed with respect to their respective strengths and weaknesses.

**Monday October 9: Underwriters Laboratory (UL) Standards** (4 hours in length)

**Organizer:** Donald E. Snyder, Manager - US Standards, Underwriters Laboratories

An overview of UL structure and scope of operations will introduce the audience to Underwriters Laboratories and set the stage for the role of Standards. Underwriters Laboratories is a leading product safety testing and certification organization and a leading product safety standards developer. This course will address how UL standards are developed and structured to reflect their use in certification. The three different types of certification will be discussed. The US safety system is a network of Model installation codes, product safety standards, test specifications/recommended practices, certification organizations, and Authorities Having Jurisdiction. The course will also explain how these entities interrelate to protect life and property in the US. Harmonization with other Standards is accelerating due to customer demands for an end to duplicate, overlapping, or conflicting Standards. At UL, there is a strong demand from manufacturers for UL to harmonize its standards with Canada and Mexico, regionally, and with IEC internationally. This presents challenges that will be discussed in the course.

**Tuesday October 10: Protection of Power Transformers** (8 hours in length)

**Organizer:** Charles (Chuck) Mozina, Consultant

The course will cover the basics of protecting power transformers at both utility and industrial facilities as discussed in IEEE/ANSI standard C37.91 (Guide for Protective Relay Applications for Power Transformers) and the IAS Buff Book (IEEE Standard 242-2001). It will also address new protection techniques made possible by modern digital transformer relays. Topics covered will include: transformer basics, why transformers fail, polarity and phasing standards (ANSI and IEC), IEEE through fault withstand capability standards, demystifying wye-delta and delta-wye phase shifts, fuse/overcurrent/ differential protection, CT requirements, slope, harmonic restraint, overexcitation limits and protection methods, commissioning and relay testing, application of fault pressure relays. The course highlights the protection of transformers grounded through 200-400A grounding resistors - a common practice at industrial facilities and on power plant auxiliary systems requiring sensitive ground differential protection. Case studies of actual in-service events will also be discussed.

**Wednesday October 11: Design and Operation of Motor Bus Transfer Schemes at Power Plants and Medium Voltage Industrial Facilities** (8 hours in length)

**Organizer:** Charles (Chuck) Mozina, Consultant

This course discusses the design and operation of automatic schemes to transfer loads from an interrupted bus section to the alternate bus within industrial facilities or power plants without damaging the motors being transferred. It is extremely important to maintain continuity of electric service to these facilities when the normal (usually utility) source has sustained an outage. Many industrial facilities have at least two independent supply sources. Each source supplies a bus section (typically at 4.16 or 13.8 KV) with a normally open bus tie between the bus sections. Upon loss of supply, the bus section must be quickly transferred to the alternate supply to avoid a major outage. A similar type load transfer occurs on power plant auxiliary systems when motor load is transferred from the auxiliary transformer supplied from the generator terminals to the start-up (station service transformer) supply. In both cases, the transfer must be done without damaging the motors supplied from the bus section that has sustained the outage. The course discusses various schemes to provide this transfer, operating experience with each scheme, as well as new designs made possible through the use of digital technology. Specific application issues and concerns are identified and addressed. (Length: Whole Day)