

# **Motor, Drive & Automation Systems** 2012

**Advancements in Motion Control and Power Electronic Technology**

**March 13-14 • Orlando, Fla.**

## **More than 25 Presentations Including:**

**Motors, Drive and Motion Control - A Global Market Update**

**Drive to a Greener Future**

**How to Make High Efficiency Motors Affordable**

**The Inverter Motor - Compact, Efficient, Dynamic**

**Technology Trends in Variable Frequency Drives**

**Motors and Drives Troubleshooting**

**Advanced Control Technologies in AC Motor Drives**

co-located with

# **MAGNETICS**

# Motor, Drive & Automation Systems 2012

Advancements in Motion Control and Power Electronic Technology

Motor, Drive & Automation Systems 2012 is an international, industry-leading conference focused on the latest economic trends and technical advancements impacting motor, drive and automation systems. Join hundreds of peers and potential business partners and discover how new technologies are improving performance, energy efficiency and providing cost savings in a variety of applications.

The event serves technical and management professionals involved in all sectors of motor, drive and automation technologies including end users, integrators, manufacturers and dealers.

If you are involved in the motor, drive or automation industries or if your products and systems use these technologies, this is a must attend event.

Motor, Drive and Automation Systems will once again be co-located with MAGNETICS 2012. Attendees to either event will have access to the combined exhibit halls and networking breaks, receptions and luncheons. For a nominal "conference upgrade" fee, attendees will have access to both conference programs.

Who will be at Motor, Drive & Automation Systems 2012:

- OEM and System Design Engineers
- System Integrators, Value Added Resellers and Dealers
- OEM Design Engineers and Development Managers
- Control Managers and Developers
- Components Developers and Providers
- Engineering and Development Managers of Motor, Drive & Automation Systems Manufacturers
- Motion Control Professionals
- Power Systems Engineers

## Stay Where the Conference Is!

The conferences will be held at the Rosen Plaza hotel.

A special room rate of \$159 is available for attendees when you reserve your room by February 20<sup>th</sup>, 2012.

Be sure to mention Webcom Communications when reserving.



Rosen Plaza Hotel  
9700 International Drive, Orlando, FL 32819  
1-800-627-8258 • [www.rosenplaza.com](http://www.rosenplaza.com)

## Monday, March 12<sup>th</sup> - Workshops

### Reluctance Motor – An Alternative to Permanent Magnets

**Presented by:** George Holling • Rocky Mountain Technologies

**When:** March 12<sup>th</sup>, 8:00 am - 5:00 pm

**Registration:** \$495

As neodymium prices keep increasing dramatically the industry is looking for alternative motor designs. One such technology are reluctance motors that can deliver high efficiency and good power density without the use of any permanent magnet materials. This workshop will look at the types of reluctance motors that are available. The course will discuss the basic performance characteristics in detail and examine how they are similar and how they differ from permanent magnet motors and discuss the implications for certain application areas.

### Reducing NdFeB Magnet Cost in Brushless PM-AC Synchronous Machine

**Presented by:** Jim Hendershot and Adrian Perregaux • Infolytica

**When:** March 12<sup>th</sup>, 8:00 am - 5:00 pm

**Registration:** \$695

Design considerations and strategies for reducing the cost of the neo-magnets in brushless DC and PM-AC synchronous machines will be explored in detail. There are two methods that will be studied; the first is to create rotor configurations that can take advantage of the new ceramic materials which are significantly less expensive than NdFeB. The second method involves changes to the magnetic circuit (rotor, stator and air gap) to allow the reduction of the thickness of the NdFeB magnet. These techniques require careful analysis of the thermal condition of the magnets beyond what is normally used for machine sizing. This necessitates the use of coupled electromagnetic-thermal simulation to optimize the minimum magnet mass, preventing demagnetization and meeting performance requirements.

### Electric Motor Power Measurement & Analysis

**Presented by:** Bill Gatheridge, Product Manager • Yokogawa Corporation of America; Ian Walker, Vice President of Sales • GMW Associates

**When:** March 12<sup>th</sup>, 8:00 am - 12:00 pm

**Registration:** \$295

This four hour workshop presented by Yokogawa Corp. will provide the attendees with a three step process for making precision electrical and mechanical power measurements on various motors and variable speed drive systems. We will show how to make precision measurements and calculate the energy efficiency for motor and drive systems in industrial and automotive operations, and renewable energy applications such as wind turbines and solar equipment.

### Field Oriented Control and Advanced AC Motor Control Algorithms

**Presented by:** Dr. Dal Y. Ohm, President • Drivetech, Inc.

**When:** March 12<sup>th</sup>, 1:00 pm - 5:00 pm

**Registration:** Before February 10<sup>th</sup>: \$295;  
After February 10<sup>th</sup>: \$395

The purpose of this course is to provide in-depth knowledge and skills in designing high performance AC motor drives. The course is intended for engineers who have prior knowledge in basic motor control theory or have some exposure in motor drive design. The course starts with the principles of FOC (field oriented control, aka vector control) and applies FOC in PM synchronous (both IPM and SPM) and induction motors.

## Tuesday, March 13<sup>th</sup>

7:00 AM Registration Opens/Continental Breakfast

8:30 AM Opening Address

8:35 AM Keynote Presentation

### Motors, Drives and Motion Control - Global Market Update

Hear the latest analysis of the global industrial motor (FHP, LV, MV), drive and motion control markets. In addition to presenting market data, the presentation will describe the current competitive environment for these products, including an analysis of the leading suppliers to these markets.



*Alex Chausovsky, Research Director,  
Electric Motors Group • IMS Research*

9:30 AM

### Protecting IGBT Modules Against Over-Temperature Using an Internal NTC Temperature Sensor

The power semiconductors used in motor drives and alternate energy systems will fail if they are operated outside their temperature limits. Being able to protect these devices against over-temperature is key to achieving long term reliability. This presentation will walk through the design process of modeling the silicon temperatures and how they relate to the internal module NTC temperature sensor. The performance of air cooled, water and phase change heatsinks will be shown under steady state, overload and loss of coolant conditions. From this data, practical over-temperature protection strategies will be discussed.



*David Levett Ph.D., Power Electronics Design and  
Applications Engineer • Infineon Technologies  
Industrial Power, Inc.*

*Jeremy Howes, Senior Mechanical Engineer  
Parker Hannifin Corp.*

### Optimizing Permanent Magnet Machines Using FEA Tools

Price of magnets and costs of operations of BLDC permanent magnet motors are a top concern in today's ever developing rotating machines applications. A need for lower costs of manufacturing is begging for the use of cheaper materials wherever possible. Core losses are a concern and in a quest for sustainability they are key to success. The use of FEA (Finite Element Analysis) tools and embedded optimizer give the designer the possibility to tackle this complicated problem of reducing core losses keeping low cogging torques.

*Philippe Wendling, Vice President • Magsoft*

10:00 AM

Exhibit Hall Opens/Networking Break

10:45 AM

### Drive to a Greener Future

Learn how to realize cost savings with state-of-the-art variable frequency drives technology. Attendees will see that variable frequency drives allow for more efficient control over processes than ever before resulting in energy savings of up to 70 percent and thereby offer a considerable reduction in their facility's overall carbon footprint. In many applications, variable frequency drives have the potential to return energy back to the facility power grid through regenerative infeed technology. Returns on investment can be realized in as little as three to six months depending on the existing installation. Additionally, the concepts of energy efficiency and the financial incentives available for energy efficient installations will be reviewed.



*Ken Kerns, Marketing Programs Manager, Motion Control  
and Low Voltage Drives • Siemens Industry, Inc.*

### Extending Design Options Using a Complete Integrated Automation and Motion Controller with Servo Drive And Network Master in a Single Compact Package

In this new machine control solution a single product provides the soft PLC functionality along the motion controller functionality as well as a one axis servo drive and an EtherCAT master for controlling additional servo axes and other network devices. This solution creates single axis machine control in one package including a variety of onboard analog and digital I/O. Systems of up to eight or more servo axes are possible by adding additional servo drives on the EtherCAT network. Development time is saved by not having to learn or interact with multiple software tools to build the system. The same software package is capable of supporting other controller offerings that provide for building systems as large as 128 axes.

*Chris Radley, Global Product Line Manager,  
Automation and System Products • Kollmorgen*

11:25 AM

### How to Make High Efficiency Motors Affordable

In many segments of the motor industry the demand for high efficiency motors is increasing due to a variety of reasons: energy cost, cooling and power/weight density. Switched reluctance motors are now routinely pushing 94 percent to 96 percent and IPM motors run as high as 98+ percent using standard steels and magnet materials. Discover some of the design trends that are used for these high efficiency motors and gives an outlook as to which technologies and motor efficiencies will become available in the near future.

*George Holling • Rocky Mountain Technologies*

### Identifying, Analyzing and Mitigating Effects on Motor Control Performance in Vector Control of PMSM Motor Applications

When optimizing performance and efficiency in a motor control application in the design stage, designers always have to consider a number of effects at various levels. There are a number of effects that occur at the motor level, sensor level and the embedded controller level that can have a relative impact on the control system dynamics that can manifest itself in a number of different ways. This presentation identifies some of the more common first-, second- and third-order effects and what it means to the motor control designer, specifically as it applies to vector control of PMSM motor applications. This presentation will show how new hardware features of 32-bit micro controller help mitigate some of the second and third order effects.

*Jeff Shoemaker • Renesas Electronics America*

12:00 PM

Networking Lunch

1:30 PM

### Advanced Control Technologies in AC Motor Drives

Discover several advanced technologies developed for permanent magnet (PM) AC, induction and switched reluctance motor drives including synchronous regulators and predictive current controllers and field weakening operation. Principles and algorithms of these technologies, relative advantages and disadvantages in performance, robustness and energy efficiency will also be discussed. In addition, this presentation will also include implementation issues, parametric models, limitations, extended operational ranges and tuning methods in practical applications.



*Dr. Dal Y. Ohm, President • Drivetech, Inc.*

*Dr. Jae H. Park, Vice President of Engineering • Drivetech, Inc.*

### Using GaN Devices to Improve the Power Efficiency in A Motor-Inverter Drive System

The advantage of using gallium nitride (GaN) power devices in inverter drives extends beyond simply reducing the power loss in the drive itself. The fast switching speed inherent in GaN devices is the key to minimizing switching loss plus it also enables the inverter drive to operate with higher PWM frequency. Higher PWM frequency in turn enables performance improvement both in the motor plus the entire system due to reduction of unwanted harmonics. Hear efficiency data for a GaN, variable-frequency inverter drive with integral output filtering, under various load conditions, as well as analysis of torque ripple reduction that may be achieved using GaN power devices.

*Jim Honea • Transphorm Corp.*

*R.H. Welch • Welch Enterprise*

2:10 PM

### New Technologies in Feedback Devices Reduce Costs And Improve Performance, Maintenance And Efficiency

In a closed loop control system, the reliability and performance of the feedback device is vital to successful motion control. The requirements of feedback encoders may vary with the kind of motor and drive used for the application; however, there are some overarching factors the influence the cost, system profitability, performance, maintenance and efficiency. A good understanding of these factors will help the OEM save design time, time to market and production costs.

*Joanna Suresh, Product Manager - Motor Feedback & Absolute Encoders • SICK, Inc.*

### High Current 1,200 V 4H-SiC Super Junction Transistors

High temperature Silicon Carbide (SiC) devices for motor control and drive applications are currently being developed. These devices offer very clean switching performance. The advantages for these devices in motor drive systems include high temperature capability that allows drive controls to be mounted directly on to the motors, clean waveforms to reduce EMI emissions and high switching frequencies improve efficiency. Until now, SiC switches were not produced with high current (>20 A) levels. Learn about a new device that offers this capability as well as high short circuit ruggedness capability and high avalanche.



*Dr. Ranbir Singh, President • GeneSiC Semiconductor, Inc.*

2:45 PM

Networking Break

3:15 PM

### Transfer Molded IGBT Module for Electric Vehicle Propulsion

This presentation will describe the characteristics of a new power module having user accessible on-chip temperature and current sensing features. Temperature sensing is accomplished by measuring the forward voltage drop of a string of diodes fabricated on the IGBT chip's surface. Current sensing is accomplished using a current mirror structure that diverts a small portion of the main emitter current to an auxiliary "sense" emitter. The on-chip sensing features are directly accessible to the end user enabling control and protection to be tailored to the specific needs of the intended application. The new module also features a unique transfer molded structure that is designed to function as a universal building block for assembling intelligent power modules of various ratings. This presentation will also discuss the features of this package and show an example of how it is assembled into an intelligent power module.

*Eric R. Motto, Application Engineering • Powerex*



### The Inverter Motor – Compact, Efficient and Dynamic

Discover the differences between inverter duty motors and optimized inverter motors, as compared to standard AC induction motors. Construction and performance differences will be examined, as well as advantages and disadvantages of each type of motor. Learn how a recent advance in optimized inverter motor design is enabling higher efficiencies and increased speed range without field weakening, all at a lower cost. Applications best suited to each type of motor will be highlighted.

*Wayne Lazznerini, Mechanical Product Manager  
Lenze Americas*



3:55 PM

### Crossing the Chasm Between PCB's and Busbars for the Power Electronics

The new markets for power electronics in the low voltage range such as electrical vehicle power train, variable frequency drives and others, demand new circuits systems that exceed the traditional printed circuit board (PCB) capabilities. Traditional laminated busbars, however are often an overkill for these applications and do not fit the applicable component interconnection technologies. The power electronics engineer now have a new circuit technology available that allows thicker conductors, makes compact 3D designs and is compatible with high volume assembly technologies.

*Al Mastrangelo, Market Development Manager -  
PDS Division Rogers Corp.*

### Adjustable Speed Motor That Does Not Trip Ground-Fault Interrupters

Adjustable speed drives commonly use an AC/DC converter front end to drive a Dc/AC inverter. The output of the inverter is generally a high frequency PWM voltage that is connected to the stator coils of an induction motor or a BLDC motor. The capacitance between the motor stator coils and the grounded motor frame cause a high frequency current to flow from the power input of the drive to ground through the capacitance. The ground current causes the GFI to trip in some cases. The DynaMotor adjustable speed motor has the stator coil connected directly to the AC line and is free of any high frequency voltage that might cause a GFI trip.

*Bill Jones, President • DynaMotors, Inc.*

4:30 PM

### New Motor Controllers Lead the Way with Analog Circuit Integration

Implementing sensorless motor-control algorithms requires measuring the phase currents from a three-phase motor. Currently, this is accomplished using shunt resistors and operational amplifiers (op amps) in circuits that are external to the digital signal controller (DSC) or microcontroller (MCU) that is running the sensorless motor-control algorithms. Analog circuits such as op amps and analog comparators are now often integrated onto the DSC or MCU. This presentation will survey op-amp integration, and investigate the resultant motor-control-system cost impact and tradeoffs, along with other integration choices, such as integrated power modules. The presentation will also explore other advantages that stem from this new integration.

*Patrick Heath, Senior Manager, Strategic Marketing, High-  
Performance Microcontroller Division  
Microchip Technology, Inc.*



## Driving Low Voltage High Speed BLDC Motors Above 1 KW

As off grid applications migrate to higher power levels, some applications will require low voltage high shaft speed or high pole count BLDC motors. While these motors can be attractive for their size/ weight footprint or for minimizing other system mechanical components, they exhibit extremely low resistance and inductance, particularly for power levels above 1 KW. This presentation will explore the challenges involved in driving such motors and present an example solution for an 18 pole, 7,000 RPM, 3 KW motor running on 36 volts DC.



*Gary Box, Founder and Chief Technical Officer  
Software Defined Power*

9:30 AM

## Circuit Protection Considerations for High-Power Motors and Controls

Motors and motor controls continue to increase in complexity and power. One of the important design considerations that is commonly over looked is protecting sensitive circuitry from fault conditions. Coordinating overcurrent, over-temperature and overvoltage protection can help designers minimize component count, comply with safety agency requirements and reduce warranty returns resulting from failed motors and damaged control boards. This presentation will review many of the solutions that currently exist and examine new solutions that address the higher power demands of motor and motor controls.

*Robert Cid, Product Engineering Manager  
TE Circuit Protection*

5:00 PM

Cocktail Reception

## Wednesday, March 14<sup>th</sup>

7:30 AM

Registration & Breakfast

8:30 AM

Keynote Presentation

## Leverage Motion Control Functionality with Universal Software Tools

Motor control is moving from a strict hardware and hard-wired environment to a networked environment with software control. Combining several motors and drives in a coordinated way is often called motion control, and this includes synchronized movements like camming and gearing. The coordination is done in software, creating flexibility in changing cam profiles and gear ratios. By using a worldwide harmonized functionality for motion control, one can create program with less hardware dependence, a higher level of reusable code, transparent programs, lower commissioning, installation and maintenance costs, wide industry acceptance, and last but not least: reduction in training costs. Also, it is easier to add embedded control functions to motors today using off the shelf software available from a number of suppliers.

*Eelco van der Wal, Managing Director • PLCopen*

## Robust, High Performance DC Electric Motors for UAV and Spacecraft Applications

Aerospace manufacturing is a high-tech industry that produces aircrafts, guided missiles, space vehicles, aircraft engines, propulsion units, and other related parts. We'll explore the various DC motor options available and the required features of these products for use in aerospace applications. Learn what specific DC motor and gearhead modifications are commonly necessary when extreme reliability is essential to the applications functionality. This presentation will also offer some examples of the motors used in a variety of high-profile space applications.

*Roger Hess, Sales Engineer, maxon precision motors, inc.*

10:00 AM

Exhibit Hall Opens/Networking Break

10:30 AM

## Results from Efficiency Testing of Switched Reluctance And AC Permanent Magnet Motors Drive Combinations

Manufacturers claim that the energy efficiency of switched reluctance (SR) and AC permanent magnet (PM) motors is at least as good as the best squirrel cage three-phase asynchronous induction motors (AC motors) operating at their best efficiency. Motor efficiency measurements point out that the energy efficiency of AC motors drops dramatically when they operate at less than 50 percent load. In contrast, complete SR and PM systems can have efficiencies well over those of their equivalent AC motors under a wide space of load conditions. Hear the most recent testing results on energy performance over the entire speed and torque range of these emerging technologies that have recently become commercially available.

*Pierre Angers, Researcher – End Use Technologies  
Hydro-Quebec Research Institute*

11:10 AM

### **Sensorless Control for High Speed Permanent Magnet Synchronous Motor**

With high speed motors being used widely nowadays, sensorless vector control systems for them become promising to avoid position sensors. The elimination of sensors could reduce the cost and increase the simplicity and robustness of the motors and the whole system. The idea behind sensorless control methods is to estimate the motor position and speed information based on measurable terminal quantities. In this presentation, different sensorless control methods are studied and compared. Simulation and test results using such these methods on a high speed motor which runs at 150 krpm are presented.

*Thomas Wu, Professor • University of Central Florida*

### **Lamination Manufacturing Techniques That Can Improve Production and Performance Efficiencies**

The manufacturing process for electrical steel laminations starts with the review of production requirements and follows many paths to their use in the assembly of the end product. For all current or new products, every phase of the lamination manufacturing process should be reviewed to determine if efficiencies of production and/or performance can be realized. Different materials could result in lower core losses. New production techniques could result in higher quality products, shorter lead time and lower costs. This presentation examines the lamination production factors that need to be reviewed for each product and gives actual examples where reviews have resulted in increased performance and cost savings.

*John Roberts, Sales Manger • Sko-Die, Inc.*

11:45 AM      **Networking Lunch**

1:00 PM

### **Recent Advances in Electric Machine Testing**

Electric machine testing has developed over the years. There are numerous techniques available for testing various types of electric machines and new techniques continue to evolve. Increased standards activities are leading to the convergence of methods of testing, particularly for motor efficiency. The upsurge in application of variable frequency drives is renewing interests in developing a unified approach to testing motor-VFD systems. The issues of comparability of test results from different test methods is critical to the acceptability of test result and the classification of motors according to their efficiency class This presentation will discuss the recent techniques as applicable to various types of electric motors including variable frequency drive systems.

*Emmanuel Agamloh, Motors and Drives Consultant  
Advanced Energy Corp.*

### **Solar, Wind and CAV Applications Influence the Development of Power Modules Used for Motor Control**

For more than 40 years the development of Thyristor, Bipolar Darlington and then IGBT modules has focused on their use in motor controllers. During this time other applications depended on the volumes needed for motor controllers to support the development of these switching power modules. As a result, the characteristics of these modules have been optimized for their motor control applications. Today, new applications for solar, wind and CAV are now shifting the direction of module development. This shift may well be to the benefit of motor control.

*Jerry Gallagher Business Development CAV & Renewable Energy Technologies  
Infineon Technologies Industrial Power, Inc.*



1:40 PM

### **Technology Trends in Variable Frequency Drives**

Variable frequency drives have emerged as a surefire way to reduce energy costs in induction motor systems saving many millions of kilowatt-hours around the world each and every year. Energy savings are only part of the VFD value proposition, they also help extend the working life of induction motors-by allowing them to operate at lower speeds for significant portions of their lifecycle. VFDs can also improve process control capabilities. VFD continues to grow more efficient and reliable due to continuous improvements in the underlying power electronics, such as the insulated gate bipolar transistor (IGBT) technologies developed. Taken together, technological advances in power electronics and computing power will take VFDs to new levels of performance and cost effectiveness in the coming years.

*Terry Webb, Chief Engineering Manager – AC Drives Business Unit • Fuji Electric of America*

### **Improved Self-Protected Intelligent Power Modules With Increased Efficiency for 10 to 100 kW Motor Drives**

A new, more efficient series of self-protected Intelligent Power Modules (IPMs) for application in 10 to 100 kW motor drives has been developed. Several new technologies including improved chip technology and structural improvements have been implemented to reduce effective junction temperature and increase power and thermal cycling capability resulting in more efficient and more reliable power modules. Compatibility with conventional dual module terminal location and spacing and package dimensions has been maintained.

*John F. Donlon, Senior Application Engineer • Powerex, Inc.*

2:15 PM

**Motors and Drives Troubleshooting**

Become more effective at troubleshooting motors and motor drives, and ultimately reduce downtime and save on costly repair bills. At the completion of the presentation the attendees should be able to make those critical decisions in order to quickly isolate a fault down to a component level, facilitating a quick and cost effective repair. The presentation covers the key measurements and troubleshooting techniques divided in three segments by measurement points: the drive input, the drive and drive output and the motor and drive train. For each of these fault conditions we go into detail of the appropriate measurement theory, measurement techniques and basics of interpreting the results as well as what the overall benefits of these techniques are.

*John Bernet, Product & Application Specialist  
Fluke Industrial Group*

**World-Wide Motor Minimum Energy Performance Standards**

This presentation will review world-wide motor policies, programs and new technologies relative to efficiencies, testing standardization and implications for the US. Recently enacted US congressional legislation will be discussed, pending efforts to regulate new motor categories and surrounding legal challenges.

*Richard deFay, Project Manager, Sustainable Electric Energy • Copper Development Association, Inc.*

2:50 PM

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|--------------------------------------|------------|------------|------------|
|                                      | (1 person) | (2 people) | (3 people) |
| Full Price:                          | \$995      | \$895      | \$795      |
| Online Registration Closes 3/6/2012: | \$1,295    | \$1,195    | \$1,095    |
| Onsite Registration Begins           |            |            |            |

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Provides access to either one of the individual days of the conference, including networking and expo activities.

|                                      |       |
|--------------------------------------|-------|
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|                                      |       |
|--------------------------------------|-------|
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| Onsite Registration Begins           |       |

### Expo Only Pass

Provides access to the exhibit area only. Exhibit Only Pass does NOT include conference CD-ROM, admittance to conference sessions or food/beverage.

|                 |      |
|-----------------|------|
| Expo Only Pass: | \$50 |
|-----------------|------|

### Pre Conference Workshops

See page 3 for pricing information.

### Ways to Register

Phone: 800-803-9488  
Web: www.e-driveonline.com

### Conference Upgrade: \$300

Provides access to both Motor, Drive & Automation Systems and MAGNETICS 2012 conferences. Includes both proceedings, networking, expo activities and reception.

### Team Discount

If two people from your company attend the conference, \$100 will be deducted from each attendee's registration fee. If three or more people from your company will be attending the conference, \$200 will be deducted from each attendee's registration fee.

*\* Teams do not have to attend the same conference to get the Team Discount (please call us at 800-803-9488 for information on this offer).*

### Contacts

#### Registration

Julie Williams at 720-528-3770 ext. 117  
or JulieW@infowebcom.com

#### Exhibit/Sponsorship

Sue Hannebrink at 330-725-5812 or  
SueH@infowebcom.com

#### Program

Shannon Given at 720-528-3770 ext.  
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