



# Texas Instruments Technology Day Milwaukee 2010 Session Titles and Abstracts

Track & Course	Abstracts
<b>Track 1 – Embedded Processors</b>	
ARM – Cortex A, R, M Overview	This session will detail the differences between Cortex A, R and M. An explanation of target applications, architecture differences (including floating versus non-floating and how they communicate) will be covered. Join this overview presentation to better understand the differences between different ARM Cortex devices.
Stellaris® ARM-Based MCUs: Communications Introduction	In this session, attendees will receive an overview of Stellaris® MCUs and the integrated communications available on-chip. Communication interfaces to be covered include Full-speed USB 2.0 On-the-Go (host and device), 10/100 Ethernet MAC+PHY, IEEE 1588 precision time protocol (PTP), CAN networking, and inter-integrated circuit sound (I2S). In addition, we will discuss the license- and royalty-free StellarisWare software.
Considerations for Choosing the Right TI ARM-Based Microprocessor	TI has introduced many new processors based on the Cortex-A8 and ARM9 architectures. This session compares ARM-based MPU options and guides you through the decision-making process. Learn the technical components that are included as part of these cores and the scalability of the different architectures.
Developing a Portable Medical Imaging Application on an OMAP™ SoC	Join this class to learn about to take the standard off-the-shelf DVSDK offering and build a portable ultrasound back-end application using the iUniversal extensions to the codec engine. Also described are details on how to take an algorithm for TI's medical software toolkit and package it for easy drop into the codec engine framework. This session will briefly review how to take the above described application and port it to the Android/Rowboat baseport.
Introduction to Code Composer Studio™ IDE v4.0	Code Composer Studio™ IDE v4.0 is a major new release of Code Composer Studio software that is based on the Eclipse open-source software framework. Eclipse is becoming very popular in the embedded development community and is now becoming a standard in development environments. Join this session to help get started today.
<b>Track 2 – Wireless</b>	
RF Basics, Tools and Getting Started	Have you been told by your manager to go remove the wires from the design? Not sure where to start? This presentation serves as an overview of the parameters and considerations a designer would use to select a low-power wireless solution. It also highlights devices and tools from TI and how they fit in a typical low-power RF design.
Range Considerations for RF Networks	This course will cover the theories behind antennas and RF range and discuss what occurs when line of sight is not an option. Antenna types and sizes will be compared, as well as elements in near field (plastic enclosures) and far field (a wall) when introduced into a system. Finally, these considerations will be applied to a link budget example.
Fundamentals of Antenna Design by LSR	Antenna design is one of the most intimidating and important parts of any RF design. It is critical to understand the key factors involved when choosing an antenna topology, as well as what tools are needed for design, simulation and characterization. Designs must account for the effects of the enclosure material, the available space, the required radiation patterns, EMC compliance rules and regulations. This presentation discusses the fundamentals of antenna design for short-range devices, as well as the trade-offs between size, cost and performance. An antenna that is properly designed and optimized will enhance the overall performance of any radio.
Frequency-Hopping Software Solution for TI LPRF Radios	Do you need more distance in your system? A few more dB in your link budget? Changing to frequency-hopping spread spectrum (FHSS) signaling can allow you to increase your transmitted power by as much as three orders of magnitude over standard narrow-band signaling in the ISM bands. In this session, you'll learn how to design and implement FHSS systems to achieve targeted specifications, followed by an overview and demonstration of TI's upcoming release of the SimpliciTI™ network protocol with FHSS support.
Energy Harvesting by Cymbet	This session provides an overview of how to design autonomous wireless sensors using various energy-harvesting transducers; energy conversion circuits; energy storage with permanent thin-film battery technology; sensors; and TI's MSP430™ MCU, CC2500 and CC430. Various configurations of autonomous self-power sensors based on energy harvesting will be detailed. Low-power EH RF system architectures will be discussed and design examples will be shown. An example of a zero power wireless sensor will be demonstrated using the eZ430-RF2500-SEH demo kit and the new DigiKey self-powered CC430 weather station reference design.



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<b>Track 3 – Medical</b>	
Market Drivers and Technology Enablers for Wireless Connectivity in Medical	This session will explore low-power wireless technologies including ZigBee, 802.15.4, WLAN and RFID. Also discussed will be the existing and potential spectrums used for the medical space and their applicability for different applications. Learn how these technologies compare by looking at several different attributes such as data rate, range, power consumption, packet error rate, interference tolerance, network topologies and relative cost. Some various medical examples will be shown where wireless technologies are used.
Sensor Signal Conditioning and Interface for Medical	Precision analog in medical applications is critical to the interface of biological sensors and embedded processing. In this session we'll explore the various sensor interface techniques and solutions available.
Discrete and Integrated ECG Design Concepts	This presentation will cover the fundamental concepts of the ECG as well as some of the most common signal chain concerns for ECG design engineers. We will conclude with an overview of the ADS129x, TI's newest line of integrated ECG devices for 3-12 lead systems, which will reduce the cost, power consumption and overall component count in your next-generation ECG design.
Passive Low Frequency Wireless (PaLFi) Solutions for All Applications, Including Medical	Learn about the integration of MCU-RF devices with MSP430 MCU products in the development of HF readers and passive non-battery-operated MSP430 solutions. MCU-RF products enable wireless communication with an MSP430 MCU and attached sensor networks without a battery by scavenging RF energy and providing two-way communication. This session offers an in-depth design overview of HF readers and passive non-battery-operated RF solutions by integrating MCU-RF products with an MSP430 MCU. We will cover the available tools to handle SPI and parallel communication, design layouts, over-the-air protocols and RF antenna design methodologies for MCU-RF products. Attendees will be walked through the design of a short-range, passive, non-battery-operated temperature sensor solution. Some pertinent medical applications will also be shown.
Contactless Charging	This presentation provides an overview of contactless charging principles based on e-coupled technology targeted at low-power (<5 W) applications. The success of this emerging technology depends on a universal standard that enables interoperability between various transmitters and receiver solutions. This session will also provide an overview of the Wireless Power Consortium (WPC) and its efforts to create a standard focused on delivering interoperable solutions.
<b>Track 4 – Motor Control</b>	
Intro to Motors and Motor Control	This session will talk about the different types of motors used in the industry: DC, brushless DC, steppers, permanent magnet synchronous and AC induction. To gather a better understanding of motors, differences of these motors with advantages and disadvantages of each will be shown. Basic motor drive circuits will be discussed from full H-bridge drive to half-bridge for three-phase motors. Other drive concepts such as six-step commutation, along with drive issues such as current recirculation, will also be discussed. Field-oriented control will also be covered and how it has progressed with improving technology. This session will end with instructions on how to implement a motor control application using TI solutions from analog products, digital controllers and software to precisely control the position, velocity and torque of mechanical drives.
Digitizing Your Motor Control Design	Today's motor control systems almost invariably use a microprocessor or microcontroller to close the control loop digitally. The economical advantages of this approach are obvious, but the impact to your system performance is much more subtle. How does quantization affect system performance? How can you analyze the stability of your composite analog/digital signal path? How do you know if your sampling frequency is high enough? What processor features are really important for optimized performance? Are there software tools and techniques you can use to ease the development effort? This session discusses some of the analytical methodologies you can use to answer these questions (including several motor control simulation examples), which take the guesswork out of designing your digital motor control system.
Field-Oriented Control of Permanent Magnet Motors	Building on the previous session, we investigate the field-oriented control process in an easy-to-understand way using animations and simulations. We then introduce the topic of observers and how they can be applied in a field-oriented application to eliminate the motor shaft sensor, resulting in sensorless control.
Digital Motor Control MCUs	This session explores the overall methodology, features and example systems available for motor control with TI microcontrollers.



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Development and Simulation of Control Algorithms Using MATLAB Targeted for TI C2000™ Microprocessors	Most products require short time to market and low development costs while maintaining high reliability and possibly high underlying complexity. Complexity in products has shifted to the software domain because it is relatively easy to change. Unfortunately, developing complex algorithms on higher powered electronic platforms can result in "exciting" failures. Failures can be minimized by testing the algorithms on system-level simulations. These simulations couple the software domain and associated timing constraints with a model of the physical power electronics. Utilizing MATLAB-Simulink – coupled with the SimPowerSystems toolbox and the MATLAB native programming language – a system-level model can be created to represent the physical power electronics in addition to the control loop implemented in a DSP. This allows for the development of algorithms in safe environments before implementation on physical hardware. The underlying control schemes were written in a manner such that they could be relatively easily ported over to C and implemented in a TI C2000™ DSP. The example to be presented was targeted for a very high-efficiency 6-kW inverter.
<b>Track 5 – Power Supply Design, SEM1900</b>	
Incorporating Active-Clamp Technology to Maximize Efficiency in Flyback and Forward Designs <b>and</b> Under the Hood of Flyback SMPS Designs	For telecom and PoE applications up to 25 W, single-ended forward and flyback topologies offer the lowest potential cost; however, using active-clamp technology can increase the efficiency of both, particularly when synchronous rectification is appropriate for the outputs. Subjects to be addressed in this topic include obtaining zero-voltage switching; selection and driving of synchronous rectifier FETs; optimizing transformer design; and a side-by-side comparison of equivalent forward and flyback solutions, emphasizing the performance benefits of each topology that can be achieved as a trade-off against circuit complexity and cost. In the second part of this session, a basic review of the flyback switching topology as applied to low-voltage DC/DC converters will be presented with an emphasis on "not so obvious" design issues, including effects of parasitics, fault protection and EMI mitigation. Modeling and analysis will be demonstrated and compared with physical hardware measurements. A major sub-topic will be the understanding and characterization of the flyback transformer, considering leakage inductance, cross regulation, parasitic capacitance and other performance-defining paramete
Designing an LLC Resonant Half-Bridge Power Converter	While half-bridge power stages have commonly been used for isolated, medium-power applications, efficiency requirements with high-voltage inputs encourage the use of resonant switching, an improvement that comes with added design complexity. However, the LLC half-bridge converter topology offers several performance benefits. This paper provides detailed design information on its implementation, eased with a unique analysis tool for frequency modulation control, that of first harmonic approximation (FHA). The FHA method is used to define circuit parameters and predict performance, which is then verified through comprehensive laboratory measurements.
Power Factor Correction Using the Buck Topology – Efficiency Benefits and Practical Design Considerations <b>and</b> New Product Offerings from Texas instruments	Although active power factor correction is typically accomplished with a boost power topology, this topic will show that there are significant efficiency advantages offered by a buck power stage – particularly when universal line operation is required. Specific design and performance issues such as bus voltage choice, achievable THD and power factor, control algorithms and design practicalities will be discussed. Design choices and their implications are illustrated with a practical buck PFC design example based on a 90-W high-density notebook power adapter demonstrating a PF > 0.9 over a 20- to 90-W load range, and >96% full-load efficiency over 100-230 Vac line.  In the second part of this session, information on significant new power control products will be solicited from TI business managers, with the criteria for selection that a data sheet and samples will be available by September 2010.
Designing Magnetic Components for Optimum Performance in Low-Cost, AC/DC Converter Applications	With the assumption that the reader is familiar with basic magnetic design theory, this topic provides design guidance to achieve high efficiency, low EMI and ease of manufacturing for the magnetic components found in typical offline power converters. Magnetic component designs for a 90-W notebook adapter and a 300-W "silver-box" power supply are used as examples. Applications to be considered include the input EMI filter, PFC inductor, high voltage level-shifting gate drives, and single and multiple-output forward-mode transformers in both wound and planar format. The techniques are also applied to flyback "transformers" and will enable lower profile designs with lower intrinsic common-mode noise generation.
A New Dual Half-Bridge, DC/DC Converter with Wide-Range ZVS and Zero Circulating Current <b>and</b> Designing a Solar-Cell Driven LED Outdoor Lighting System – A Comparison of Digital and Analog Power Control Solutions	A new digitally controlled high-power converter topology combines two half-bridge inverters to operate as a full-bridge power stage using phase-shifting control, but with zero circulating current. Each power switch operates with a nominal 50 percent duty cycle to achieve zero-voltage switching over a widely varying load, but can also function in a PWM mode for increased voltage range. A 1-kW, 400-V/48-V converter designed to validate the concept is shown achieving a 96+ percent efficiency and a high power density. In the second part of this session, we will use a medium power solution to illustrate the many considerations of designing a complete solar-powered LED light system, homing in on the unique demands of both the solar array and LED lamps and integrating them with a storage battery, charger and all the control circuitry. Both analog and digital solutions will be proposed and compared on the basis of functionality, complexity and cost.

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