Texas Instruments
Tech Day: Boston - Sept. 14, 2010
Session Titles and Abstracts

Track and Course	Abstracts
Medical and Low-Power Wireless	
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.
Everything You Wanted to Know About the SimpliciTI™ Network Protocol (Parts 1 to 3)	This course and workshop will cover the SimpliciTI v1.1.1 network protocol stack and how it can be used to develop simple but very robust wireless networks. The data hub configuration typically used by most customers will be covered in detail. This course will provide laptops with IAR software already installed and will also employ eZ430-RF2500 development boards.
High Speed and Analog Design Tools	
miniDSP and TI Audio Codecs: Architecture, Signal Processing Capabilities, Software	TI's latest audio codecs include a digital signal processor optimized for digital audio signal processing. This session will explain the architecture of the miniDSP engine, capabilities of the miniDSP and software development for the miniDSP engine, and show digital signal processing examples.
Analog Design Tools: SwitcherPro™ Software, FilterPro™ Software and TINA-TI™ Software	This session provides an overview of some useful design software tools TI is creating for analog and power system designers. SwitcherPro™ software quickly generates switching-mode power supplies with real-world components from user-provided specs. FilterPro™ software creates active filters (low-pass, high-pass, bandpass and time-delay) from user-provided specs. TI macro models, which can be used in TINA-TI™ software and other simulators, provide the ability to simulate transient behavior such as circuit start-up, steady state, shut down, non-linear noise effects and line/load regulation.
High-Speed Layout Considerations	This topic will discuss the high-speed models of common components and the key points to address in high-speed layout. We will discuss when to use ground planes and when to clear them, along with optimum circuit routing, bypass capacitors, avoiding ground loops and vias, and controlling impedance with transmission-line techniques. In addition, many high-speed signal chains will involve a mixed-signal boundary where the analog domain crosses into the digital domain. This seminar will provide guidance as to the factors you need to consider when crossing domains, with steps on creating a successful data-converter layout for your high-speed design.
Interfacing Data Converters with FPGAs	This presentation will address common issues with interfacing data converters with FPGAs. Information on device selection, interface support and communication will be covered.
Practical Implementation of Clocking Solutions for High-Speed Data Converters	Maintaining the ideal performance of high-speed data converters is very dependent on providing the proper clocking solution. This presentation will focus on understanding the clock performance requirements dependent on data-converter device selection and operating frequency. Clock source devices are often specified by a jitter parameter; however, for data-converter applications the phase noise parameter specified over an appropriate bandwidth is a better gauge to determine clocking suitability. The techniques for converting phase noise performance to jitter specs are explored to facilitate acquiring the required devices for clocking the data converter. The difference in clocking requirements is explored for DACs and ADCs and for system implementation that require clocks for both types of devices. For ADC applications where clock performance is especially critical, tools and techniques will be presented to predict expected SNR performance for a desired ADC with a given aperture jitter and thermal noise floor at the selectable IF frequency. Practical device
Power and Precision Analog	
Power for Digital Designers: DC/DC Converters 101	This presentation is an introduction to power supplies for non-power supply engineers. If you are an engineer that works on systems that require power, but you don't design the actual power supply, this presentation is for you. It defines and explains some of the terminology surrounding power supplies and explains why you might use one topology over another. Example topics include efficiency considerations and how they relate to the differences between synchronous and non-synchronous converters. We will explain many terms you may have heard but not fully understood, such as split rail, PSRR, converter vs. controller, LDO vs. linear regulator and buck vs. boost. This presentation will not show you how to design a power supply, but it will help you to understand what power supply designers are talking about.
EMI Basic Principles and Understanding Inductors and Transformers *by Wurth*	This presentation will cover types of electromagnetic interference over various frequency ranges and the classifications of interference. We will also discuss conducted modes such as differential-mode interference and common-mode interference, and touch on some areas of radiated interference, with recommendations for lowering interference and visual examples of the impacts of different solutions. Basic information about materials such as loss characteristics, frequency of operation and inductive properties will also be included, along with reasons for choosing material and magnetic components for various circuit applications. Our discussion will include shielded components versus un-shielded and the results of these within the circuit, as well as various methods to lower or filter unwanted signal noise in order to meet FCC Class B limits.
Deciphering Electrical Characteristics in an Op-Amp Datasheet	The operational amplifier (op amp) is often the key analog gain block in acquiring and scaling real-world signals in any data-acquisition system. To predict system accuracy when using op amps, it is important to understand the op-amp data sheet and how individual specifications affect both the DC and AC transfer accuracy through the op amp. Both DC and AC limitations will be discussed in detail. With this knowledge, any engineer can design with op amps right the first time.

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Instrumentation Amplifier Noise Analysis	This presentation covers calculation, simulation and measurement of intrinsic noise in an instrumentation amplifier. Intrinsic noise is noise generated by resistors, op amps and other active devices in the circuit. The presentation does not cover extrinsic noise (e.g. RFI and EMI pick-up), but it does cover specific real-world examples where the peak-to-peak output noise is predicted, simulated and measured. Using an instrumentation amplifier correctly to avoid internal node saturation will also be covered.
Data Conversion: Specs to Systems	Many resources exist that define analog-to-digital converter (ADC) errors, but few relate these errors to a system design and identify how they will have an impact on the end product. This presentation will relate ADC specifications to real-life system designs and gauge their impact on the end product performance, features and specifications. As a fringe benefit, you will find discovery questions embedded in this presentation for your system designers that are unfamiliar with ADC specifications. These questions will help you and your customer identify which converter specifications will have the most impact on a specific design and lead to a final product selection. You will leave this presentation with a good working knowledge of the relationship between ADC specifications and the impact they have in end product designs, making you the "go-to guy" for your customer's ADC selection decisions.
Microcontrollers	
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.
Introduction to Stellaris® ARM Cortex-M3 MCUs	TI's Stellaris® MCUs pair the ARM Cortex-M3 core along with advanced communication capabilities, including 10/100 Ethernet MAC+PHY, CAN, USB On-the-Go, USB Host/Device, SSI/SPI, UARTs and I²C. TI also provides an extensive range of more than 20 superb reference design, evaluation and development kits starting at $49. Stellaris MCUs are targeted at highly connected applications including monitoring, building controls, network appliances and switches, factory automation, electronic point-of-sale machines, test and measurement equipment, medical instrumentation, and gaming equipment. This presentation provides an overview of Stellaris MCUs, software tools and kits, StellarisWare™ software, and applications. The session will close with a free-form Q&A session to handle your questions on the more than 140 microcontrollers in TI's Stellaris family of MCUs.
FRAM: Opening New Horizons for Embedded Developers	Ferroelectric random access memory (FRAM) is the next-generation non-volatile memory technology for ultra-low-power embedded microcontrollers. Its fast write capability (like DRAM), practically unlimited write endurance (>1,014 cycles) and ultra-low power consumption benefits developers and end users alike. In this presentation, we will describe FRAM's ability to function as universal memory, helping ease the life of developers and reducing development time (i.e., faster time to market) and costs. In addition, FRAM enables several new, exciting ultra-low power applications such as batteryless intelligent sensors; we will look at the power consumption advantages of FRAM in one such application. FRAM also offers significant advantages over incumbent technologies in several other applications such as energy harvesting, sensoring, datalogging and motor control.
Bringing TI's *Bluetooth*® Technology to Embedded MCU Platforms	As TI expands the reach of our connectivity platforms, we are putting new tools in the hands of customers to quickly and easily add connectivity to products based on TI embedded processors like the MSP430™ MCU. In this session, we will introduce the newest platform offering that integrates TI's BlueLink™ product family with the MSP430 solution. You will learn about the platform's features, capabilities, differentiators and how to position this offering with your customers. You will also get to see the platform in action, as we demonstrate a gaming and a health care sample application running on an MSP430F5438 experimenter board.
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 the TI CC2500, CC430 and MSP430™ MCU. Various configurations of autonomous self-power sensors based on energy harvesting will be discussed, along with low-power EH RF system architectures and design examples. An zero-power wireless sensor will be demonstrated using the eZ430-RF2500-SEH demo kit and the new Digi-Key self-powered CC430 weather station reference design.

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Motor Control	
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, we will show the differences between them and discuss the advantages and disadvantages of each. Basic motor drive circuits will be covered, from full H-bridge drive to half-bridge for three-phase motors, as well as other drive concepts such as six-step commutation and drive issues such as current recirculation. Field-oriented control will also be discussed and how it has progressed with improving technology. This session will end with how to implement a motor control application using TI 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 economic advantages of this approach are obvious, but the impact to 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) that will take the guesswork out of designing digital motor control systems.
Types of Motors and Control Techniques	Building on the previous session, we take a look at some of the different types of motors and digital control techniques being employed in various applications and examine the critical system areas that can affect performance.
Digital Motor Control MCUs	This session explores the overall methodology, features and example systems available for motor control with TI microcontrollers.
Design and Implementation of Motor Control Systems with MATLAB Simulink and TI C2000™ Processors	This presentation highlights the development and implementation of a control application for a C2000™ MCU using MATLAB and Simulink. Topics discussed include algorithm design and simulation, test-bench specification, fixed-point design trade-offs, automatic code generation, algorithm profiling, and system verification through processor-in-the-loop testing. Performance optimization through the use of processor-specific code blocks will also be presented.
Embedded Microprocessors	
Linux Development Tutorial on TI Processors	This presentation will explore the various Linux development options available for TI's DaVinci™ and OMAP™ processors. We will discuss both community and commercial offerings, including the benefits of each.
Introduction to TI's Cortex-A8 Family of Devices	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. You'll learn the technical components that are included as part of the these cores, as well as the scalability of the different architectures.
Introduction to ARM Hands-On Workshop (Part 1 of 3)	This is a combined lecture and hands-on lab session. The discussion starts with an overview of TI's devices and software development kits. The heart of presentation examines TI's Linux options, including an overview of Linux itself; where you can get versions of Linux for TI platforms (including Arago, TI's open embedded Linux distro); and how to build within the Linux environment. The session's discussion ends with a brief, practical examination into using Linux on embedded platforms. After booting the system with an SD/MMC card, the lab gets you working within the Linux graphical user environment, just as if you were working on a desktop computer. If you have time after exploring the GUI, there are additional, optional exercises to explore Linux's networking applications and boot environment, and how to mount various file systems.
Introduction to ARM Hands-On Workshop (Part 2 of 3)	This is a combined lecture and hands-on lab session. The discussion starts with an overview of TI's devices and software development kits. The heart of presentation examines TI's Linux options, including an overview of Linux itself; where you can get versions of Linux for TI platforms (including Arago, TI's open embedded Linux distro); and how to build within the Linux environment. The session's discussion ends with a brief, practical examination into using Linux on embedded platforms. After booting the system with an SD/MMC card, the lab gets you working within the Linux graphical user environment, just as if you were working on a desktop computer. If you have time after exploring the GUI, there are additional, optional exercises to explore Linux's networking applications and boot environment, and how to mount various file systems.
Introduction to ARM Hands-On Workshop (Part 3 of 3)	This is a combined lecture and hands-on lab session. The discussion starts with an overview of TI's devices and software development kits. The heart of presentation examines TI's Linux options, including an overview of Linux itself; where you can get versions of Linux for TI platforms (including Arago, TI's open embedded Linux distro); and how to build within the Linux environment. The session's discussion ends with a brief, practical examination into using Linux on embedded platforms. After booting the system with an SD/MMC card, the lab gets you working within the Linux graphical user environment, just as if you were working on a desktop computer. If you have time after exploring the GUI, there are additional, optional exercises to explore Linux's networking applications and boot environment, and how to mount various file systems.

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Embedded Processing Tools	
Introduction to Code Composer Studio™ IDE v4 Hands-On Workshop (Part 1 of 2)	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 many development environments. Bring your own laptop and leave ready to begin development; however, we will also have laptops on hand. Join this hands-on session to help you get started today.
Introduction to Code Composer Studio™ IDE v4 Hands-On Workshop (Part 2 of 2)	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 many development environments. Bring your own laptop and leave ready to begin development; however, we will also have laptops on hand. Join this hands-on session to help you get started today.
Visual DSP Programming Using the c6flo Development Tool	C6000™ DSPs can greatly accelerate fixed- and floating-point computations in digital systems. Unfortunately, harnessing the DSP core is daunting, particularly for ARM-focused developers who just want to offload intensive signal processing tasks. To speed up development for experts and non-experts alike, TI has created c6flo, a graphical development tool for C6x DSPs. This presentation summarizes the technology behind c6flo and demonstrates just how easy it is to create a working DSP application.
MSP430™ MCU Hands-On Lab (Part 1)	This hands-on workshop is intended to educate experienced MCU designers on the capabilities of the MSP430F5xx. You will experience embedded design with the MSP430™ MCU, get familiar with an MSP430 development environment, learn where to find and how to use resources, and better understand the MSP430 low-power concept. The course is perfect for those getting started or those who need a refresher on MSP430 microcontrollers. Basic experience with general MCUs and knowledge of assembler and C language programming is assumed.
MSP430™ MCU Hands-On Lab (Part 2)	This hands-on workshop is intended to educate experienced MCU designers on the capabilities of the MSP430F5xx. You will experience embedded design with the MSP430™ MCU, get familiar with an MSP430 development environment, learn where to find and how to use resources, and better understand the MSP430 low-power concept. The course is perfect for those getting started or those who need a refresher on MSP430 microcontrollers. Basic experience with general MCUs and knowledge of assembler and C language programming is assumed.
Power Supply Seminar – SEM1900	
SEM1900: Incorporating Active-Clamp Technology to Maximize Efficiency in Flyback and Forward Designs **and** SEM1900: 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, utilizing 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. A basic review of the flyback switching topology as applied to low-voltage DC/DC converters will be presented in this part of the session, with an emphasis on not-so-obvious design issues, including the effects of parasitics, fault protection and EMI mitigation. Modeling and analysis will be demonstrated and compared with physical hardware measurements. A major subtopic will be the understanding and characterization of the flyback transformer, considering leakage inductance, cross regulation, parasitic capacitance and other performance-defi
SEM1900: Designing an LLC Resonant Half-Bridge Power Converter	Although 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 session provides detailed design information on its implementation, eased with a unique analysis tool for frequency modulation control, that of first harmonic approximation (FHA). This FHA method is used to define circuit parameters and predict performance, which is then verified through comprehensive laboratory measurements.
SEM1900: Power Factor Correction Using the Buck Topology: Efficiency Benefits and Practical Design Considerations **and** SEM1900: 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 total harmonic distortion and power factor, control algorithms, and design practicalities will be discussed. Design choices and their implications will be 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 percent 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.

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SEM1900: Designing Magnetic Components for Optimum Performance in Low-Cost, AC/DC Converter Applications	With the assumption that the attendee is familiar with basic magnetic design theory, this session 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 formats. The techniques are also applied to flyback transformers and will enable lower profile designs with lower intrinsic common-mode noise generation.
SEM1900: A New Dual Half-Bridge DC/DC Converter with Wide-Range ZVS and Zero Circulating Current **and** SEM1900: 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 PWM mode for increased voltage range. A 1-kW, 400-V/48-V converter designed to validate the concept will be shown achieving a 96+ percent efficiency and a high power density. The second part of this session will use a medium-power solution to illustrate the many considerations of designing a complete solar-powered LED light, homing in on the unique demands of both the solar array and LED lamps and integrating them with a storage battery, charger and control circuitry. Both analog and digital solutions will be proposed and compared on the basis of functionality, complexity and cost.