2008–2009
Power Supply
Design Seminar

Texas Instruments

Seminar Topic Titles and Abstracts (SEM1800)

Topic 1: ***High Power Factor or a High Efficiency – You Can Have Both***
Authors: Isaac Cohen and Bing Lu

Abstract: Past expectations have been that while improving power supply power factor can offer significant and necessary reductions to distribution losses, the addition of an active PFC stage will negatively impact the supply's internal efficiency. But it doesn't have to be this way. This topic shows that by understanding the differences between PF and THD and the implications of designing for universal AC line voltage ranges, several new system architectures are possible to minimize system power losses while still meeting power quality requirements.

Topic 2: ***Understanding Noise-Spreading Techniques and Their Effects in Switch-Mode Power Applications***
Authors: John Rice, Dirk Gehrke and Mike Segal

Abstract: A downside to all the many benefits of SMPS power conversion has always been the potential for noise generation from the high dv/dt and di/dt of the power pulses. When the many techniques for mitigating the generation of EMI still fail to provide the necessary noise margin, the application of Spread-Spectrum Frequency Dithering may well provide a solution. This topic explores the modulation techniques, models the behavior in SPICE, and examines real-world behavior in two practical examples.

Topic 3: ***Under the Hood of a DC/DC Boost Converter***
Author: Brian Lynch

Abstract: Despite having the same number of significant power components as the well-understood buck converter, the boost converter has the reputation for lower performance coupled with a more complicated design. This topic discusses the boost converter in practical terms describing both continuous-mode and discontinuous-mode operation, and presents an easy-to-use mathematical model for the analysis of both voltage-mode and current-mode feedback control.

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Seminar Topic Titles and Abstracts (SEM1800) *(Continued)*

Topic 4: ***Improving System Efficiency With a New Intermediate Bus Architecture***
Author: Rais Miftakhutdinov

Abstract: Ever growing demand for efficient and high quality tele- and data-communication power systems have driven the replacement of centralized power supplies with distributed architectures. Recently, a new Intermediate Bus design has gained popularity by providing lower cost, superior power quality, and higher efficiency while taking advantage of the newest advances in power components. This topic provides a brief overview of the historical evolution of high-reliability power systems, and then focuses on the benefits and design challenges of the Intermediate Bus Architecture with an example illustrating the control requirements for a practical IBA converter design.

Topic 5: ***High-Voltage Energy Storage – The Key to Efficient Hold Up***
Author: Jean Picard

Abstract: This topic provides a tutorial for designing a high-voltage energy storage system in order to minimize the cost and size of a storage capacitor bank. The first part of this topic uses the basics of energy to demonstrate the benefits and limitations of high-voltage storage with quantitative illustrations of volumetric reduction and energy density, while the second part describes the critical aspects of a HVES design. Possible topologies and control techniques are compared, design challenges of the recharge and hold up modes and their impact on power losses are discussed, and guidelines for a practical design example are provided with both simulated and measured test results.

Topic 6: ***Using a PMBus for Improved System-Level Power Management***
Author: Kurt Hesse

Abstract: This topic provides a brief high-level introduction to the PMBus Standard for controlling a power supply using an enhanced serial interface, and then describes the more common and basic PMBus commands. Several system level tasks are presented with possible ways to implement them using the facilities that may be available to the designer using a PMBus-enabled converter or controller with the salient features of the PMBus highlighted. Finally, an example specification and the PMBus commands required for its implementation are illustrated with an application incorporating a suitable controller.

Seminar Topic Titles and Abstracts (SEM1800) *(Continued)*

Topic 7: ***Applying Digital Technology to PWM Control Loop Designs***
Authors: Mark Hagen and Vahid Yousefzadeh

Abstract: This topic discusses the application of digital control to dc/dc switching converters and how to model the digitally controlled system. The main blocks that appear in almost every digital controller – the error ADC, the compensator and the digital PWM engine – are discussed and used to model small signal characteristics such as frequency response, stability criteria, and the effects of quantization, as well as the impact of sampling rate and delay introduced by the digital controller to the system. This model is extended to include nonlinear gain and the benefits are shown. Finally, a graphical user interface is introduced and demonstrated for use with the design of a two-phase synchronous buck converter.

Topic 8: ***An Introduction to New Products for More Effective Power Solutions***
Author: Bob Mammano

Abstract: This brief topic will highlight some of the more recently introduced products from TI emphasizing their more significant performance characteristics and descriptions of the benefits that they might bring to achieve more cost-effective power solutions with easier-to-design implementations.