Short Course and Consulting Proposal
2002

Submitted by:

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Dear Colleague;

Thank you for your interest in DCHopkins & Associates, and considering the possibility of our providing an on-site seminar and consulting. DCHopkins & Associates specialize in the complete development, design and fabrication of electronic energy systems. This includes power supplies, motor drive modules, pulsed power, lighting ballasts, etc. There is unique specialty in high density, high frequency power electronic systems with particular emphasis on power packaging.

Founded in 1977, DCHopkins & Associates are a group of select individuals that offer a complete solution from electronic innovation to product production, including research, funding solicitation and marketing. Each individual has over fifteen years of experience as an industry leader and is well recognized through their technical publications and professional involvement.

A complete Course Listing is given below. See also the attached Suggested Outline of learning modules for a two-day program. Note that we offer two course formats. One is a professional short course presentation, as you would receive at the IEEE Applied Power Electronics Conference or IEEE-WESCON, for example. The other would be attuned to your needs.

Integrated on-site consulting can be provided along with regular course material. Combining half-day course work with half-day in-lab consulting is very effective in addressing focused company needs while providing more effective use of dollars from several budgetary sources. The consulting does not need to be limited to course related material. See Pricing Information.

I look forward to your call.

Dr. Douglas C. Hopkins

POWER ELECTRONIC SYSTEMS

By
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1. Introduction to The System (1 hr.)
   The history of the power electronics industry is briefly reviewed and discussion is given showing how components and circuits have evolved from selenium rectifiers to high temperature electronics.
2. Knowing Your Specifications and the User's Requirements (2 hrs.)
   A framework provides a comprehensive approach to specifying systems. Electrical input and output requirements are developed in detail separating out what is assumed and is commonly misunderstood
3. Design for Safety, Standards, Certificates & Regulations (2 hrs.)
   Nearly all designs must meet the scrutiny of UL, CE, CSA, etc. A discussion is given regarding which certification is required and what steps need to be taken.
4. Knowing Where Disaster Can Strike, Inductive Switching (2 hrs.)
   Mother nature strongly objects to abrupt changes and easily provides excessive voltage transients, particularly when currents in inductors are interrupted. An in-depth look at the effects of circuit parasitics is given along with good design practices. This is an essential presentation to all in power electronics design.
5. Choosing the Correct Topology (2 hrs.)
   The gambit of linear, hard-switched, quasi- and fully-resonant, and resonant-transition topologies are described and criteria for matching topology to application are given. Details are given on design with linear regulators. (This is an introduction to Switch-mode and Resonant Topologies.)
6. Introduction to Switch-mode Topologies (6 hrs.) (Design included)
   The workhorse of power electronics is switch-mode topologies. A Buck Converter design is used as an example to show the reality of switch design. Design calculations, predicted waveforms and component specifications are given.
7. Introduction to Resonant Topologies (advanced topic, 6 hrs.) (Design included)
   This is an advanced topic and addresses the growing need in very high efficiency circuits. Resonant topologies offer many operating modes not obvious and require special analysis approaches.
8. Characterizing Passive Power Components (2 hrs.)
   There are many new components available and some with particular operating limitations. Power resistors, switching and filter capacitors, magnetics, sensors and fuses are described and characterized with emphasis on how their use and rating is affected by high currents, voltages and temperature. Component models and design tips are given. The magnetics section is excluded if the "Magnetics Design" section is presented
9. Magnetics Design Can Be Fun (4 hrs.)
   Magnetics design has never been easy. This in-depth treatment of inductors and transformer is approached from materials, modeling and direct design examples. Parasitics are quantified as both elements to be minimized or used as part of resonant switching circuits. A magnetic amplifier design as used in multiple-output power supplies is also reviewed. When cost is considered, more attention may needed in mounting and circuit partitioning.
10. Input Filtering, (Not selective hearing) (3 hrs.) (Design included)
    Considerable cost in components and certification is found in the input circuitry. How to minimize the design time, components and the certification cycle is a topic unto itself. The filtering is a major cost center and needs in-depth understanding.

11. Characterizing Power Switching Components, Diodes and Rectifiers (3 hrs.)

Selected devices, such as power Diodes, MOSFETS, IGBTs, SCRs and GTOs, are described in detail along with drive requirements and techniques. Though some devices are of old origin, many are now used in protection and fault management circuits. Device models are developed as part of the characterization. Overlooked devices, such as the unijunction transistor, are also included.

12. The Dual Faces of Power MOSFETS, Synchronous Rectification (1 hr.)

To achieve very low output voltages at modest efficiencies, the voltage drop of rectifiers must be reduced. One approach uses a MOSFET as a switched diode. However, there are many tradeoffs in cost and complexity, besides intellectual property.

13. Power Packaging Approaches (4 hrs.)

Power electronic circuits convert many types of energy, such as electric, magnetic and thermal. Why do only electrical designs? This presentation moves from physical specification through characterization of different packaging approaches and characterization of materials. Given is a comprehensive framework to identify packaging issues and is essential of all designers.

14. The Circuit is a Component (2 hrs.)

The end product is a physical circuit and this circuit provides many parasitics that must be considered during electrical design. This presentation characterizes the physical circuit and the effects on the electrical circuit behavior. It is a must for high density and high frequency design. (This is a lengthy presentation.)

15. Be In Control Quickly (4 hrs.)

Several approaches are now developing in power electronics control: vendor supplied ASIC, mixed signal and all digital. At the foundation remains basic control principals for multi-loop control. This presentation develops the basics of power electronics control, such as stability, voltage, peak current, average current. Models are given as used in simulators.

16. Simulating Reality, Our best guess at Mother Nature (3 hrs.)

There are many options to circuit simulation. Designers can now complete nearly 90% of their designs through simulation. What is available and what are the limitations? Demonstration of macro and behavioral modeling is applied to components and circuits in power switching applications. Several case studies are given with emphasis on where certain simulators have quirks and limitations. If requested, spatial simulators for electromagnetic and thermal analysis can also be included.

17. A Different Approach to DESIGN, Full-Cost Modeling and Circuit Partitioning (1hr.)

A unique "cradle to grave" design example of a pump motor drive is provided. This case-study highlights, top down, how the physical design can drive partitioning and modularization in a product design rather than the electrical requirements. The result provides the lowest cost bottom-line solution.

18. Starting Knowledge in Application Notes (3 hrs.) (Design included)

Access to on-line design notes and even software tools, has never been greater. However, "app note designs" do have limitations that can cause final difficulties in designed around early. Key app notes are identified and several designs discussed in detail.

19. Intensive Design Case Study (1 Day, culmination)

A company supplied problem will be accepted and a comprehensive "cradle to grave" electrical design will be performed. This proceeds from review of specifications through complete design including identification of components. The procedure follows a framework and demonstrates the thinking process.

THE END

PRICING INFORMATION

Costs to the company include travel and living expenses for the instructors, and course expenses as given in the table below. A minimum of six registrants is required, although a single registration can be shared among several people. (Only one person per registrant can be seated in the class.) Courses can be taught in half-day sessions only when following at least one full day of presentations. Half-day pricing is given in the table below.

A special value to many companies is to combine courses with on-site consulting. The instructors move their course discussions into the company's labs to assist designers in applying what they learned. The instructors also provide direct consulting discussions on non-course related topics.

Courses are based on eight contact hours and can be scheduled for evenings and weekends. A handout master is provided to the company for reproduction and distribution of copies to each *registrant*. Extra copies are $55.00 each. One hour of consulting per instructor per day is provided at no charge for the "course only" options.

ON-SITE COURSE FEES*

Full-Day Sessions	
1 Day	$495/person
2 Day	$895/person
3 Day	$1195/person
Half-Day Sessions following one or more full days	$350/person

*Minimum of six registrants

EXAMPLE OF 3-DAY AND EQUIVALENT SCHEDULE

	MON	TUE	WED	THU	FRI	SAT	SUN
am							
pm							
am							
pm							
am							
pm							

ON-SITE COURSE FEES WITH COMBINED CONSULTING*

Half-Day Course Sessions with Half-Day Consulting	
1 Day	$495/person
2 Day	$895/person
3 Day	$1,245/person
4 Day	$1,550/person
5 Day	$1,895/person

*Minimum of six registrants

SUGGESTED OUTLINE

1	**Introduction to The System (1 hr.)** The history of the power electronics industry is briefly reviewed and discussion is given showing how components and circuits have evolved from selenium rectifiers to high temperature electronics.
3	**Design for Safety, Standards, Certificates & Regulations (2 hrs.)** Nearly all designs must meet the scrutiny of UL, CE, CSA, etc. A discussion is given regarding which certification is required and what steps need to be taken.
4	**Knowing Where Disaster Can Strike, Inductive Switching (2 hrs.)** Mother nature strongly objects to abrupt changes and easily provides excessive voltage transients, particularly when currents in inductors are interrupted. An in-depth look at the effects of circuit parasitics is given along with good design practices. This is an essential presentation to all in power electronics design.
6	**Introduction to Switch-mode Topologies (6 hrs.) (Design included)** The workhorse of power electronics is switch-mode topologies. A Buck Converter design is used as an example to show the reality of switch design. Design calculations, predicted waveforms and component specifications are given.
13	**Power Packaging Approaches (4 hrs.)** Power electronic circuits convert many types of energy, such as electric, magnetic and thermal. Why do only electrical designs? This presentation moves from physical specification through characterization of different packaging approaches and characterization of materials. Given is a comprehensive framework to identify packaging issues and is essential of all designers.
Total time: 2 Days or 1Day + 2 Half-Day Sessions, or 4 Days of course +consulting	