

Practical Power Magnetics Design Technique

With Basic Fundamentals

2008

**This Presentation will be a PowerPoint Projection.
The outline and the contents are on the following pages.**

**Kg Magnetics, Inc
Colonel Wm. T. McLyman**

Learn the Practical Fundamentals of Power Magnetics Design

Now my presentation is available on CD the entire lecture 44 segments 818 pages in *pdf* format. Colonel Wm. T. McLyman 2-day course, ***Practical Power Magnetics Design Technique with Basic Fundamentals***. Colonel McLyman is recognized across the world as the foremost authority in magnetic design, with fifty years of experience in the field of Magnetics, along with fourteen United States Patents on magnetics-related concepts. He has lectured in the United States, Canada, Mexico and Europe over the past 20 years on the design and fabrication of magnetic components.

I am now available to give in house presentations of my course “***Practical Power Magnetics Design Technique with Basic Fundamentals***”. The in house presentation can be tailored to the customer requirements. The course covers a variety of basic topics including magnetic fundamentals and materials; dynamic B-H loop; permeability and the air-gap; eddy currents and fringing flux; magnet wire, foil, and insulation; regulation; magnetic cores; design fundamentals; minimizing leakage inductance and winding capacitance; transformer converter magnetics; flyback and forward converter magnetics and much more. The course also includes design exercises to help attendees get the greatest benefit from attending.

During his thirty years at Jet Propulsion Laboratory (JPL), in power conversion and as the magnetic specialist, Colonel McLyman wrote over seventy JPL Technical Memorandums, New Technology Reports and Tech-Briefs on the subject of magnetics and circuit design for power conversion. He has worked on projects for NASA including the Pathfinder Mission to Mars, Voyager I and II, Topex/Poseidon, Cassini, Galileo, Magellan, Viking, International Solar Polar, Hubbell Space Telescope, Seasat, SIR-C, Mars Global Surveyor, NSCAT, and the Deep Space Network.

A few highlights of Colonel McLyman’s career include:

- Designing the Galileo signal rotary transformers used by the Command Data System (CDS), when the slip rings produced excessive noise on the 1-Mbit data bus. The performance of the signal rotary transformer exceeded all expectations. The rotary transformer on the Galileo Spacecraft lasted the life of the spacecraft, from 1989 to 2003, without a glitch.
- Designing the Quiet Converter with its low noise environment into programs such as WF/PC-II, Articulated Fold, Mirror Actuators (Hubbell Space Telescope), MISR (Earth Orbiting System), Raman, and Mars 05 ONC, CCD Camera.
- Authoring four popular textbooks: Magnetic Core Selection for Transformers and Inductors, Transformer and Inductor Design Handbook, Designing Magnetic Components for High-Frequency DC-DC Converters, and the newly released book, High Reliability Magnetic Devices: Design and Fabrication.

Colonel McLyman is currently a consultant/contractor for SRS (JPL), Siemens Medical Solutions, and Sanders Aircraft Technology, Inc. He has finished a SBIR, Phase I contract from NASA for the development of a high-frequency power sine-wave rotary transformer converter for terrestrial and space exploration.

**Practical Power Magnetics Design Technique
with Basic Fundamentals
818 Slides**

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9. Tapped Push-Pull Inductor #2
10. Tapped Push-Pull Inductor #3
11. Tapped Inductor Simple Analogy

12. Forward Conv. with Tapped Ind.
13. References

32 Composite and Modified Cores

1. Title, Composite and Mod. Cores
2. Introduction
3. Nickel Iron Composite Cores #1
4. Nickel Iron Composite Cores #2
5. Nickel Iron Composite Cores #3
6. Nickel Iron Composite Cores #4
7. Ferrite Cores with Step Gap
8. Composite Powder Cores
9. Composite Powder/Ferrite Cores
10. Laminations Interleave and Butt
11. Paralleling Cores

33 Designing Volt-Second Devices

1. Title, Designing Volt-Sec. Devices
2. Introduction
3. Volt-Sec. Device as Series Delay
4. Volt-Sec. Device as Pulse Clamp
5. Selecting the Magnetic Material
6. Volt-Sec. Device and the BH Loop
7. Volt-Sec. Device and Material
8. Resetting the Volt-Second Device #1
9. Resetting the Volt-Second Device #2
10. Applying Volt-Seconds
11. Volt-Second Equation
12. Square Wave Drive Circuit
13. Calculating the Volt-Seconds
14. Selecting the Core
15. Volt-Second Delay Application

34 Power Factor Correction

1. Title, Power Factor Correction
2. Introduction
3. Power Factor Correction
4. Capacitance Input Filter
5. Inductor Input Filter
6. Bst PFC Converter
7. Buck-Bst PFC Converter
8. Boost and Buck-Boost Waveforms
9. Advantages and Disadvantages
10. PFC Bst. Design Specification
11. PFC Bst. Ind. Design Steps (2-3)
12. PFC Bst. Ind. Design Steps (4-5)

13. PFC Bst. Ind. Design Steps (6-7)
14. PFC Bst. Ind. Design Steps (8-9)
15. Step (10) Using Design Aids #11
16. PFC Bst. Ind. Design Steps (11-12)
17. PFC Bst. Ind. Design Steps (13-14)
18. PFC Bst. Ind. Design Steps (15-16)
19. PFC Bst. Ind. Design Steps (17-18)
20. PFC Bst. Ind. Design Steps (19-20)
21. PFC Bst. Ind. Design Steps (21-22)
22. PFC Bst. Ind. Design Steps (23-24)
23. PFC Bst. Ind. Design Steps (25-26)
24. PFC Bst. Ind. Design Steps (27-28)
25. References

35 Rotary Transformer

1. Rotary Transformer Design
2. Introduction
3. Slip Ring in General
4. Problems with Slip Rings
5. Comparing Slip Rings and RT
6. Basic Rotary Transformer
7. Rotary Transformer Configuration
8. Flat Plane
9. Open View Flat Plane
10. Axial
11. Open View Axial
12. Power Conv. Design Problem #1
13. Large Space Between Pri. & Sec.
14. Power Conv. Design Problem #2
15. The Inherent Air Gap
16. Selecting the Correct Converter
17. Voltage-fed Converter
18. Transformer Sizing VA
19. Current-fed Converter
20. Current-fed Sine wave Inverter
21. Transformer Sizing VA
22. Current-fed Sine wave Inverter
23. What is the Impact
24. Waveform #1
25. Schematic
26. Accessory Circuit #1
27. Accessory Circuit #2
28. Application
29. Pictorial Flat Plane RT
30. Pictorial Axial RT
31. Reference

36 Area Product Derivation Trans

1. Ap Derivation for Transformers
2. Simple Isolation Transformer
3. Power Handling Ability
4. Constant K_u
5. Combining Equations
6. Input and Output Power
7. Area Product Equation

37 Area Product Derivation Ind

1. Ap Derivation for Inductors
2. Input and Output Inductors
3. Energy Handling Ability 1
4. Energy Handling Ability 2
5. Energy Handling Ability 3
6. Energy Handling Ability 4
7. Energy Handling Ability 5
8. Energy Handling Ability 6

38 Core Geometry Derivation Ind

1. K_g Derivation for Inductors
2. Reg. and Energy Handling Ability
3. Constant K_g and K_e
4. Defining Inductor Power
5. Regulation α
6. Inductance and Flux Equation
7. Regulation and Power Handling 1
8. Regulation and Power Handling 2
9. Regulation and Power Handling 3
10. Regulation and Power Handling 4
11. Regulation and Power Handling 5

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1. K_g Derivation for Transformers
2. Reg. And Power handling Capability
3. Constants K_g and K_e
4. Isolation Transformer
5. Regulation α
6. Reg. And Power Handling Ability 1
7. Reg. And Power Handling Ability 2
8. Reg. And Power Handling Ability 3
9. Reg. And Power Handling Ability 4
10. Reg. And Power Handling Ability 5
11. Reg. And Power Handling Ability 6

40 Saturable Reactor

1. DC Current Transformer
2. Designing Saturable Reactors
3. Saturable Reactor Schematic
4. Designing Saturable Reactors 1
5. Designing Saturable Reactors 2
6. Designing Saturable Reactors 3
7. Designing Saturable Reactors 4
8. Designing Saturable Reactors 5
9. Designing Saturable Reactors 6
10. Designing Saturable Reactors 7
11. Offset Voltage
12. Designing Saturable Reactors 9
13. Materials Used for Power
14. Materials Used for Transducers
15. Core Matching
16. Unbalanced Gates
17. Designing Saturable Reactors 14
18. Designing Saturable Reactors 15
19. Typical Transfer Function
20. Linear Transfer Function
21. Designing Saturable Reactors 18
22. Designing Saturable Reactors 19
23. Low Power Current Transducer 1
24. Low Power Current Transducer 2
25. Low Power Current Transducer 3
26. Schematic
27. Low Power Current Transducer 5
28. Low Power Current Transducer 6
29. Low Power Current Transducer 7
30. Low Power Current Transducer 8
31. Reference

80 Design #1 Powder Core

1. Title, Powder Core Inductor Design
2. Circuit Schematic
3. Idealized BH Loop
4. Powder Core Design Specification
5. Powder Core Design Steps (1-2)
6. Powder Core Design Steps (3)
7. Step (4) Using Design Aids #3
8. Powder Core Design Steps (5-6)
9. Powder Core Design Steps (7-8)
10. Powder Core Design Steps (9-10)
11. Powder Core Design Steps (11-12)
12. Powder Core Design Steps (13-14)

13. Powder Core Design Steps (15-16)
14. Powder Core Design Steps (17-18)
15. Powder Core Design Steps (19-20)
16. Powder Core Design Steps (21-22)

82 Design #2 Gapped Inductor

1. Title, Ferrite Core Gapped Inductor
2. Circuit Schematic
3. Idealized BH Loop
4. Ferrite Ind. Design Specification
5. Ferrite Ind. Design Steps (1-2)
6. Ferrite Ind. Design Steps (3)
7. Step (4) Using Design Aids #3
8. Ferrite Ind. Design Steps (5-6)
9. Ferrite Ind. Design Steps (7-8)
10. Step (9) Using Design Aids #1
11. Ferrite Ind. Design Steps (10-11)
12. Ferrite Ind. Design Steps (12-13)
13. Ferrite Ind. Design Steps (14-15)
14. Ferrite Ind. Design Steps (16-17)
15. Ferrite Ind. Design Steps (18-19)
16. Ferrite Ind. Design Steps (20-21)
17. Ferrite Ind. Design Steps (22-23)
18. Ferrite Ind. Design Steps (24-25)

84 Design #3 HF Power Converter

1. Title, HF Push-Pull Trans. Design
2. Circuit Schematic
3. Idealized BH Loop
4. Transformer Design Specification
5. Calculating the Wire Size Step (A-B)
6. Calculating the Wire Size Step (C-D)
7. Transformer Design Steps (1-2)
8. Transformer Design Steps (3-4)
9. Step (5) Using Design Aids #4
10. Transformer Design Steps (6-7)
11. Transformer Design Steps (8-9)
12. Step (10) Using Design Aids #1
13. Transformer Design Steps (11-12)
14. Transformer Design Steps (13-14)
15. Transformer Design Steps (15-16)
16. Transformer Design Steps (17-18)
17. Transformer Design Steps (19-20)
18. Transformer Design Steps (21-22)
19. Transformer Design Steps (23-24)
20. Transformer Design Steps (25-26)

86 Design #4 Isolation Transformer

1. Title, Line Isolation Trans. Design
2. Circuit Schematic
3. Transformer Design Specification
4. Transformer Design Steps (1-2)
5. Transformer Design Steps (3)
6. Step (4) Using Design Aids #6
7. Transformer Design Steps (5-6)
8. Transformer Design Steps (7-8)
9. Transformer Design Steps (9-10)
10. Transformer Design Steps (11-12)
11. Transformer Design Steps (13-14)
12. Transformer Design Steps (15-16)
13. Transformer Design Steps (17-18)
14. Transformer Design Steps (19-20)
15. Transformer Design Steps (21)