

NPTEL Video Lecture Topic List - Created by LinuXpert Systems, Chennai

NPTEL Video Course - Electrical Engineering - NOC:Digital Control in Switched Mode Power Converters and FPGA-

Subject Co-ordinator - Prof. Santanu Kapat

Co-ordinating Institute - IIT - Kharagpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

- Lecture 1 - Digital Control in Switched Mode Power Converters - Course Introduction
- Lecture 2 - Digital Control of SMPCs - Course Instructions, Guidelines and Resources
- Lecture 3 - Examples of Some Commercial Digital Control Solutions
- Lecture 4 - Overview of Digital Control Implementation Platforms
- Lecture 5 - Introducing Basic Digitization in Power Electronic Converters
- Lecture 6 - Recap of Feedback and Feedforward Control Methods in SMPCs
- Lecture 7 - Recap of Fixed and Variable Frequency Modulation Techniques
- Lecture 8 - Levels of Digitization in Single-loop Feedback Control in SMPCs
- Lecture 9 - Levels of Digitization in Multi-loop Feedback Control in SMPCs
- Lecture 10 - SMPC Topologies and Power Stage Design for Hardware Demonstrations
- Lecture 11 - Basics of Sampling under Fixed and Variable Frequency Modulation
- Lecture 12 - Voltage Mode Digital Pulse Width Modulators and Sampling Methods
- Lecture 13 - Overview of Digital Pulse Width Modulator Architectures
- Lecture 14 - Sampling Methods under Fixed Frequency Current Mode Control
- Lecture 15 - Overview of Fixed Frequency Current Mode Control Architectures
- Lecture 16 - Sampling Methods under Constant On/Off - Time Digital Modulation
- Lecture 17 - Constant On/Off- Time Mixed-Signal Current Mode Control Architectures
- Lecture 18 - Sampling Methods under Digital Hysteresis Control Methods
- Lecture 19 - Overview of Digital Hysteresis Control Architectures
- Lecture 20 - Summary of Digital Current Mode Control Architectures
- Lecture 21 - Recap of Voltage and Current Mode Control Implementation using MATLAB
- Lecture 22 - MATLAB Model Development for Basic Digital Control Blocks
- Lecture 23 - MATLAB Model Development for Fixed Frequency Digital Control
- Lecture 24 - MATLAB Models for Digital Controllers using Difference Equations
- Lecture 25 - MATLAB Model Development for Digital Voltage Mode Control
- Lecture 26 - MATLAB Model Development for Mixed-Signal Current Mode Control
- Lecture 27 - MATLAB Model Development for Fully Digital Current Mode Control
- Lecture 28 - MATLAB Model Development for Constant-On Time Control
- Lecture 29 - MATLAB Model Development for Constant-Off Time Control

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- Lecture 30 - MATLAB Model Development for Digital Current Hysteresis Control
- Lecture 31 - Continuous-Time Small-Signal Modeling under Digital Control
- Lecture 32 - Discrete Time Modeling with Closed Current Loop
- Lecture 33 - State-Space Modeling and Steps For Deriving Discrete-Time Models
- Lecture 34 - Derivation of Discrete-Time Large-Signal Models
- Lecture 35 - Validation of Discrete-Time Large-Signal Models using MATLAB - Part I
- Lecture 36 - Validation of Discrete-Time Large-Signal Models using MATLAB - Part II
- Lecture 37 - Derivation of Discrete-Time Small-Signal Models - I
- Lecture 38 - Derivation of Discrete-Time Small-Signal Models - II
- Lecture 39 - Discrete-Time Transfer Functions and Closed Loop Block Diagrams
- Lecture 40 - Model Accuracy with MATLAB Case Studies - Comparative Study
- Lecture 41 - Continuous-Time to Discrete-Time Conversion Methods - A Summary
- Lecture 42 - Recap of Frequency Domain Design of Analog VMC and CMC
- Lecture 43 - Design under Digital Voltage Mode Control - Frequency Domain Approaches
- Lecture 44 - Design under Digital Current Mode Control - Frequency Domain Approaches
- Lecture 45 - Design Case Study and MATLAB Simulation of Digital Voltage Mode Control
- Lecture 46 - Design Case Study and MATLAB Simulation of Digital Current Mode Control
- Lecture 47 - Time Optimal Control of a Buck Converter and Identifying Performance Limits
- Lecture 48 - Trajectory based CMC Design for Proximate Time Optimal Recovery
- Lecture 49 - Trajectory based Digital CMC Tuning and MATLAB Case Studies
- Lecture 50 - Digital Pulse Skipping Control and MATLAB Simulation Case Studies
- Lecture 51 - Selection of ADC and DAC in Digitally Controlled SMPCs
- Lecture 52 - High Frequency Current Sensing Techniques in Digitally Controlled SMPCs
- Lecture 53 - Current Sensing Techniques in Digitally Controlled High Power Converters
- Lecture 54 - Signal Conditioning Circuits and PCB Design for Mixed-Signal Implementation
- Lecture 55 - Reference Power Stage Design and Schematic for Buck and Boost Converters - I
- Lecture 56 - Reference Power Stage Design and Schematic for Buck and Boost Converters - II
- Lecture 57 - Step-by-Step Guidelines for Digital Control Implementation using FPGA
- Lecture 58 - Test and Measurement of a Buck Converter using Digital Storage Oscilloscope
- Lecture 59 - Functionalities in Mixed Signal Oscilloscope for Validating Digital Control
- Lecture 60 - Power Spectrum Analysis of SMPCs using Mixed-Signal Oscilloscope
- Lecture 61 - Introduction to Verilog Hardware Description Language (HDL)
- Lecture 62 - Guidelines for Verilog HDL Programming - Some Key Rules
- Lecture 63 - Structural and Dataflow Modeling in Verilog HDL for Combinational Logics
- Lecture 64 - Behavioral Modeling in Verilog HDL for Sequential Digital Circuits
- Lecture 65 - Simulation of Verilog-HDL based Design using Xilinx Webpack - I
- Lecture 66 - Simulation of Verilog-HDL based Design using Xilinx Webpack - II
- Lecture 67 - Fixed Point Implementation in Embedded Control System
- Lecture 68 - Fixed Point Arithmetic and Concept of Q Format

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- Lecture 69 - Counter-based DPWM with Deadtime and Verilog HDL Programming
- Lecture 70 - Simulating Counter-based DPWM with Deadtime using Xilinx ISE Simulator
- Lecture 71 - Top Down Design Methodology in Digital Voltage Mode Control - I
- Lecture 72 - Top Down Design Methodology in Digital Voltage Mode Control - II
- Lecture 73 - Digital PID Control Implementation using Verilog HDL Programming
- Lecture 74 - Digital PID Controller - Hardware Implementation and Experimental Results
- Lecture 75 - Top Down Design Methodology in Mixed-Signal Current Mode Control
- Lecture 76 - Top Down Design Method and Verilog HDL Programming of Mixed-Signal CMC
- Lecture 77 - Verilog HDL based Digital PI Control Implementation of Mixed-Signal CMC
- Lecture 78 - Hardware Implementation of Mixed-Signal CMC and Experimental Results
- Lecture 79 - Voltage based Digital Pulse Skip Modulation and Top Down Design Method
- Lecture 80 - Implementing Digital Pulse Skip Modulation and Experimental Results
- Lecture 81 - STM32 Overview and STM32G4x ecosystem
- Lecture 82 - Getting started with STM32CubeMX - Part I
- Lecture 83 - Getting started with STM32CubeMX - Part II
- Lecture 84 - Practical implementation of LLC converters - Part I
- Lecture 85 - Practical implementation of LLC converters - Part II
- Lecture 86 - Texas Instruments C2000 Real-time Microcontroller Devices
- Lecture 87 - Getting Started with C2000 - Software and Hardware Development
- Lecture 88 - Texas Instruments C2000 key peripheral differentiations
- Lecture 89 - Texas Instruments TIDM-02008 Reference Design Overview
- Lecture 90 - Texas Instruments TIDM-02008 Reference Design Software Overview
- Lecture 91 - Steps for FPGA Implementation of Digital Voltage Mode Control
- Lecture 92 - Steps for FPGA Implementation of Mixed-Signal Current Mode Control
- Lecture 93 - Instability in Digital CMC and Ramp Compensation with Experimental Results
- Lecture 94 - Benefits of Constant Off-Time and On-Time Digital CMC Techniques
- Lecture 95 - Top Down Design Methodology of Constant On/Off-Time Control
- Lecture 96 - Verilog HDL Implementation of Voltage based Constant On-Time Control
- Lecture 97 - FPGA Implementation of Constant On/Off-Time Mixed-Signal CMC
- Lecture 98 - Stability Comparison of Fixed and Variable Freq. Digital CMC with Experimental Results
- Lecture 99 - Assessment of Digital Control Techniques for Light Load DC-DC Converters
- Lecture 100 - Adaptive On-Time Digital Control in DCM with Verilog HDL Implementation
- Lecture 101 - MATLAB Simulation of a Practical Digital VMC Buck Converter in CCM
- Lecture 102 - Data Acquisition and Steps for Validating Simulation and Experimental Results
- Lecture 103 - Loop Shaping and Design of Digital Voltage Mode Control in a Buck Converter
- Lecture 104 - Digital VMC Design for Shaping Output Impedance in a Buck Converter
- Lecture 105 - Hardware Case Studies and Transient Performance in Digital VMC Buck Converter
- Lecture 106 - Design and Simulation Case Studies in a Mixed-Signal CMC Buck Converter
- Lecture 107 - Hardware Case Studies and Transient Performance in a Digital CMC Buck Converter

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- Lecture 108 - Analysis of Output Impedance in Digital CMC with Load Current Feedforward
- Lecture 109 - Load Current Feedforward in Digital CMC Buck Converter: Experimental Results
- Lecture 110 - Need for Multi-Mode Digital Control and Design Requirements in SMPCs
- Lecture 111 - Implementing Bi-frequency Spread Spectrum in Digital VMC using Verilog HDL
- Lecture 112 - Performance of Bi-frequency Spread Spectrum DPWM and Experimental Results
- Lecture 113 - Top Down Design Methodology of PWM/PSM Multi-Mode Digital Control
- Lecture 114 - Verilog HDL based FPGA Prototyping of PWM/PSM Multi-Mode Digital Control
- Lecture 115 - FPGA Prototyping of Peak Current based PWM/PFM Multi-Mode Digital Control - I
- Lecture 116 - FPGA Prototyping of Peak Current based PWM/PFM Multi-Mode Digital Control - II
- Lecture 117 - Industry-Driven Architectures for Digital Control IC in High Frequency SMPC
- Lecture 118 - Industry-Driven Architectures for Digital Control System Solutions in SMPCs
- Lecture 119 - Exploration of Architectures, Modeling, Design, and Control - Course Summary
- Lecture 120 - Key Takeaways and Course Usefulness for Skilled Manpower Development