CONTROL AND TUNING METHODS IN SWITCHED MODE POWER CONVERTERS

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PRE-REQUISITES : Qualification (i) BE/B.Tech in Electrical/Electronics Engg. (degree completed or final year UG students) or (ii) PG M.Tech in Power Electronics or Power Systems or Control Systems (degree enrolled or completed) or (iii) one year or more experience in power electronics or power management converters.

INTENDED AUDIENCE : M.Tech, Ph.D. as well as final year B.Tech students from AICTE approved institutes, design engineers from power management and power electronics industries, such as TI, STMicroelectronics, INTEL, Qualcomm, GE, NXP, Mahindra Electric, HCL, TCS, etc.

INDUSTRIES APPLICABLE TO : TI, STMicroelectronics, INTEL, Qualcomm, GE, NXP, Mahindra Electric, TCS, HCL Technology, Microchip Technology

COURSE OUTLINE :

Switch mode power converters (SMPCs) play the central role in energy-efficient power conversion in emerging applications, such as electric vehicles, data centers, renewable energy, industrial automation, etc. In this context, selection of suitable control and modulation techniques of SMPCs is very important to meet challenging requirements in terms of transient performance, efficiency, line and load regulation, disturbance rejection, etc. While majority of commercial controller implementations are based on pulse width modulation and small-signal analysis, increasing switching frequencies, linking in part to wide bandgap devices, provide the opportunity to increase operating bandwidth and enhance performance.

ABOUT INSTRUCTOR :

Prof. Santanu Kapat received the M.Tech. and Ph.D. degrees in Electrical Engineering (EE) from IIT Kharagpur, India, in 2006 and 2010, respectively. He was a Visiting Scholar with the ECE Department, University of Illinois at Urbana-Champaign, USA during 2009 to 2010, and a Research Engineer with GE Global Research, Bengaluru from 2010 to 2011. Since August 2011, he has been with the EE Department (EED), IIT Kharagpur, where he is presently an Associate Professor.

COURSE PLAN :

Week 1: Switched mode power converters and MATLAB simulation

Week 2: Modulation techniques in SMPCs

Week 3: Fixed frequency control methods

Week 4: Variable frequency control methods

Week 5: Modeling and Analysis techniques in SMPCs

Week 6: Small-signal performance analysis

Week 7: Small-signal design and tuning of PWM voltage mode control

Week 8: Small-signal design of current mode control

Week 9: Large-signal model and nonlinear control

Week 10: Boundary control for time optimal recovery

Week 11: Large-signal controller tuning method

Week 12: Performance comparison and simulation