

Soft Switched & Resonant DC to DC Converter Topologies & their control

A GIAN COURSE

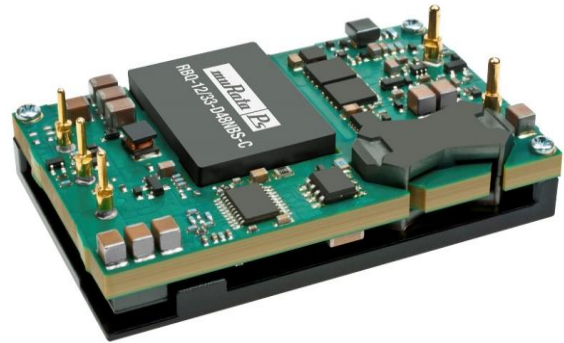
Venue: MNNIT ALLAHABAD

Date: 19 to 23 December 2016

By

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Host by: Prof. Vineeta Agarwal (MNNIT Allahabad)

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OVERVIEW

Linear DC-DC converter has poor efficiency and bulky construction. This has been replaced by switched (buck, boost, buck-boost converter) DC-DC converter topology nearly 40 years back. Converter has higher efficiency than linear converters and they have been controlled by PWM technique. Conventionally all these converters share common ground between input and output terminals and hence called non-isolated topologies. Another class of converter has been proposed for isolating input and output (isolated converter-flyback, forward and push-pull converter etc.). Hundreds of converters have been proposed in literature to improve efficiency, reduction in voltage and current stress, input output conversion ratio- all belonging to hard switched converters. These converters called hard switched because of device commutation at non-zero voltage or current resulting in switching losses. To increase the efficiency of hard switched DC-DC converters soft switched converters has been proposed by researchers. These soft switched converters are switched either at zero voltage (ZVS) or zero current (ZCS) by resonating the switch auxiliary circuit or resonant input/output circuits this found a new class of DC-DC converter called resonant DC-DC converter topology. At present it is difficult to simulate the conceptual working of converters, their advantages, applications/utility of a particular converter topology and most challenging is their close loop control. This workshop will try to develop the DC-DC converter technologies from most fundamental and conceptual level.

Objective

The primary objectives of the course is to

- Exposing participants to
 - a. Fundamentals of Resonant DC-DC converter topologies, its working and analysis,
 - b. Modeling and simulation technique for the converter,
 - c. Hardware aspects of realizing DC-DC converter topologies,
 - d. Design of close loop controller for resonant converter
- Exposing participants to industrial applications of converter topologies and related issues
- Enhancing the capability of the participants to identify, control and remove related problems of DC-DC converter topologies used in engineering system.

Course Details

Topic	Content
Introduction	What is power electronics? Design of drivers, Topological trade-offs
	,Hard switching converters
Variable frequency resonant converters	Converter topologies: Series resonant, Parallel resonant
	Series-parallel resonant
	Control techniques : Variable frequency; SSOC
	Performance evaluation
Constant frequency resonant converters	Converter topologies: Series-tuned resonant, Parallel-tuned resonant,
	Series-tuned and parallel-tuned resonant
	Control techniques: Phase-shift; APWM,Performance evaluation
Design of resonant converters	Selection of converter topology, Resonant circuit design, Filters design, Snubbers design.
	Selection of semiconductor switches
Soft-switching converters	Converter topologies: Natural commutated topologies
	Series inductor topology, Parallel inductor topology, Auxiliary commutated topologies
Design of soft-switching converters	Selection of converter topology, Filters design, Snubbers design
	Selection of semiconductor switches.
Practical applications	Applications of converter topologies in telecommunications,
	computers, renewable, energy, lighting, aerospace and electric vehicles

The Faculty



Dr. Praveen Jain is a Professor of Electrical and Computer Engineering, a Tier 1 Canada Research Chair in Power Electronics, and Director of the Queen's Centre for Energy and Power Electronics Research (ePOWER) at Queen's University. His 36-year career is marked by significant contributions to the theory and practice of power electronics, and through his considerable work with industry, such as

Astec, Freescale, General Electric, Intel and Nortel. In the late 1980s he played a key role in the design and development of high frequency power conversion equipment for the International Space Station at Canadian Astronautics. Subsequently he made pioneering contributions in introducing resonant power conversion technology in telecommunications during his work at Nortel in the 1990s. He is the founder of two successful start-up companies, CHiL Semiconductor, specializing in digital power solutions (acquired by International Rectifier), and SPARQ Systems, developing innovative photovoltaic micro-inverters.

Dr. Jain has supervised and guided almost 100 graduate students, postdoctoral fellows, and power electronics engineers who are well placed in industry and academia. He has published over 500 papers and holds 93 patents (granted and pending). Among his many awards and honors are the Queen's Prize for Excellence in Research, the IEEE William Newell Power Electronics Award, the Engineering Medal of the Professional Engineers of Ontario, the IEEE IAS Distinguished Lecturer, Fellow of the IEEE, Fellow of the Royal Society of Canada, Fellow of the Engineering Institute of Canada, and Fellow of the Canadian Academy of Engineering.

Dr. Jain received his MASc and PhD degrees in Electrical Engineering from the University of Toronto in 1984 and 1987 respectively.

The Faculty



Dr. Vineeta Agarwal is Professor in Motilal Nehru National Institute of Technology, Allahabad, India since 2001. She became the Head of the Department of Electrical Engineering during 2005-2008. As a researcher she has original contributions in the area of Single Phase to Three Phase Cyclo-Converters and their Applications, Algorithm

Developments and SiC Converters. She has supervised large number of graduate students and guided number of M. Tech. thesis and Ph.D. thesis. She has published over 115 papers in Scientific and IEEE Conferences and Journals. She has attended various National and International conferences and also chaired various technical sessions in IEEE Conferences.

Prof Agarwal is Fellow of Institution of Engineers (India) (FIE), Senior Member of Institute of Electrical and Electronics Engineers, IEEE, and Life Member of Indian Society of Technical Education (ISTE). She is Technical Reviewer for various Journals and Conferences. She has authored two books one on Power Electronics in 2004, published by BPB publishing House, New Delhi and Sponsored by: Swiss Agency for Development & Co-Operation, All India Council for Technical Education (AICTE) and Indian Society for Technical Education (ISTE). The other book is on Fundamental of Electric Drives, published by AXIOE Books India in 2013. Her Biography has been included in Marquis Who's who in Science and Engineering 2008-2009.



Dr. R. K. Singh is a Professor of Electrical Engineering at Motilal Nehru National Institute of Technology Allahabad,

India having more than 25 years of experience in teaching & research in the field of power electronics, drives & control. He became the Head of the Department of Electrical Engineering during 2011-2013. He is member IEEE, Fellow, Institution of Engineers (India). His areas of interest are DC-DC converter, Electrical Drive & its applications. He has published more than 70 papers in Journals and conferences and supervised number of Doctoral thesis work in different areas. He has attended various National and International conferences both inside and outside the country and presented papers there. He has also chaired various technical sessions in IEEE Conferences.

Duration	Duration:19 December-2016 to 23 December-2016 Number of participants for the course will be limited to Fifty only .
Who can attend?	<ul style="list-style-type: none"> • Executives, engineers and researchers from manufacturing, service and government organizations including R&D laboratories. • Student students at all levels (B. Tech./M. Tech./PhD) or Faculty from reputed academic institutions and technical institutions.
Registration Fees	Participants from abroad: US \$200 Industry/ Research Organizations: Rs. 5000/- Academic Institutions: <ul style="list-style-type: none"> • Faculty: Rs. 3000/- • Students: Rs. 1000/- ** The above fee includes all instructional materials, computer use for tutorials, 24 hr free internet facility. The participants will be provided with single bedded accommodation on payment basis subject to availability.
Registration Process	Registrations will processed via the national GIAN portal www.gian.iitkgp.ac.in Registration fee can be directly deposited through NEFT to the designated account as given below or can be sent in the form of demand draft drawn in favor of “ Dean R&C R&D MNNIT ” payable at Allahabad. Account Name: Dean R&C R&D MNNIT Account No. 718401010000004 Bank: Vijaya Bank, MNNIT Branch, Allahabad-211004, UP, INDIA IFSC Code: VIJB0007184
Important dates	Starting Date of registration: 30 October 2016 Last Date of Registration: 12 December 2016
Course Coordinators:	Professor Vineeta Agarwal Professor Ravindra Kumar Singh
Principal Coordinator	Department of Electrical Engineering, MNNIT Allahabad 211004 Tel: +91 532 2271404 (O), +915322271624 (R) +91 9559291653 Email: rksingh@mnnit.ac.in

About the host Institute



Motilal Nehru National Institute of Technology Allahabad, Allahabad (MNNIT) offers nine B.Tech., nineteen M.Tech. Degree Programmes (including part-time), MCA, MBA, M.Sc. (Mathematics and Scientific Computing) and Master of Social work (M.S.W.) programmes and also registers candidates for the Ph.D. degree. The Institute has been recognized by the Government of India as one of the centres for the Quality Improvement Programme for M.Tech.

and Ph.D. Allahabad (25.45 N 81.85 E) is well known throughout the country for its purity and cleanliness that the city has maintained for many years. It is a holy and religious place and the meeting point of three most pious rivers namely Ganga, Yamuna and Sarasvati.

The city has always been associated with well-known personalities of the country which has aggrandized the glory of the city. The city better known as "PRAYAG" has many governmental institutions which includes MNNIT, High Court of UP, Allahabad University & tourist places like Sangam, Anand Bhawan, Narayan Ashram etc. Wide and clean roads with statues at regular squares forms a part of the attraction of the city. And at last, MNNIT is the heart of the city and one of the best institutes which ensures Quality Education

About the host Department

Department of Electrical Engineering offers one B. Tech and three M. Tech programs. Presently department has more 50 Research Scholars perusing their Ph. D. program in different areas such as Power Electronics, Control & Power Systems. The U.G. program is accredited by National Board of accreditation (NBA).