Title of the Talk: "Multiport Converters-Topologies, Design and Control"

Abstract: Growing environmental concerns and depletion of fossil fuel reserves have accelerated the adoption of renewable energy sources such as solar photovoltaic, fuel cells, and energy storage systems (ESSs) such as batteries and super capacitors in the electric power supply system. While large scale Multi megawatt) renewable energy integration in the power grid has been happening for some time now integration of energy storage systems has been a relatively recent development and has so far been restricted to the distribution level mostly due to non-availability of economic solution to the problem of universal utility scale electrical energy storage. On the other hand, electricity consumption is shifting increasingly towards DC such as Variable speed Drives, Data centers, Telecom Power supplies, and electric vehicles (EVs) charging stations. Even household applications like multimedia systems, LED Lighting, refrigerators, fans, and air-conditioning systems, are transitioning to DC for enhanced performance and energy efficiency. Thus, integration of these renewable energy and energy storage technologies enhances the strength of each and provides a foundation for developing a reliable, energy efficient and eco-friendly DC-powered distribution system in the long term. Such distribution systems go by the name DC micro-grid or Hybrid Micro-gird (having provision for both AC and DC supply / load). Typically separate DC-DC converters connect the solar PV, fuel cell, battery and super capacitor to the medium voltage DC bus while a bidirectional AC-DC converter links the utility grid. A central controller oversees all local controllers via communication links, enabling centralized monitoring, data analysis, and energy management for optimized micro-grid performance. However, instead of separate converter based architecture, a single DC-DC converter for integrating several energy sources and storage devices is increasingly being preferred due to fewer power conversion stages, reduced component count, lower costs, reduced communication overhead, and easier control. This class of DC-DC converters are called Multiport DC-DC converters. Over the past few decades a very large number of multiport converter topologies have been proposed in the literature for different applications along with their modulation, modelling, control and energy management strategies. This presentation is intended to discuss some of the most notable developments in this area along with a framework for comparison among different multiport converter technologies.

About the Speaker:

Dr. Debaprasad Kastha received the B.E. degree in electrical engineering from Bengal Engineering College, Calcutta University, India, in 1987, the M.E. degree in electrical engineering (with specialization in Power Electronics) from Indian Institute of Science, Bangalore in 1989 and the Ph.D. degree from the University of Tennessee, Knoxville, USA, in 1993.From March 1989 to December 1989 he worked in the Research and Development (Electronics) Division of Crompton

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Dr. Kastha has been teaching and doing research in the area of Power Electronics and Drives for more than three decades now and has authored 40 journal and 60 conference papers. His research interests are in the areas of Wind power Generation, Machine drives, DC Power Supply for Microprocessors and DC Distribution systems.

He has co-authored a book titled "Wind Electrical Systems"(Oxford University Press) and prepared web based and video courses on Power Electronics and Electrical Machines respectively as parts of NPTEL program of Govt. of India. He has also participated in several sponsored and consultancy projects in the areas of Industrial Robots, Chaotic behavior of power electronic converters, semi-automatic electric vehicles, Drives diagnostics, VSCF Wind Power Generation schemes, Reconfigurable Distribution Systems and development of high power Electric Vehicle chargers. Dr. Kastha has been a member of IEEE since 1994 and is a Senior Member at present.