

IEEE Lectures under distinguished Lecture Series:

By

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Lecture -1

Title: Renewable Energy Systems for Grid-fed and Off-grid Power Generation.

Abstract: *Unmitigated Green House Gas (GHG) emissions leading to climate change and global warming have brought renewable energy systems for power generation to center stage as a possible solution to save the planet. According to international energy agency (IEA), both grid-fed and off-grid power generation need to be pursued to meet the electricity demand of vast population mainly in developing world that are highly deprived at present. Wind, Bio, Hydro and Solar energies are in the forefront for vast deployment while geo-thermal and tidal systems are localized. The lecture presents an overview of different technologies for the above applications and current state of art. While grid acts as a stabilizing factor in grid fed systems, off-grid systems pose special problems due to varying nature of source and load power specific to energy source and the planned application. Challenges in development and deployment of relevant technologies are highlighted to identify engineering efforts required.*

Lecture -2

Title: Modeling and Simulation of Electric machines for energy systems and drives.

Abstract: *Electric machines are main energy converters central to energy systems and drives. Dynamic modeling of such machines is critical to analyze the systems and predict the performance under different operating conditions. Generalized circuit modeling of electric machines under specific assumptions is an area of importance to engineer and planned in this lecture. Transformation of original equations to specific frames is resorted to simplify modeling and simulation. From a general model, equations of specific machines are derived for steady state and dynamic studies. Different mathematical techniques employed to solve the resultant complex equations are explained with examples. Recent MATLAB tools for simulation and performance prediction of such systems are illustrated.*

Lecture -3

Title: General Design Aspects of Electric machines and recent trends.

Abstract: *Electric Machines are extensively employed for power generation and motion control. There are conventional and special machines based on the application. Synchronous and asynchronous machines are in the forefront made in large numbers and ratings. DC machines which reigned supreme once is finding diminished use over the years confined to variable speed drives. Permanent Magnet (PM) and Switched reluctance motors (SRM) are attempted for increased penetration although confined to niche applications. In small power ratings, 1-phase motors find predominant use in domestic and commercial sectors. Design aspects of these machines are of importance to engineers. There are some general aspects of design governing these machines being covered in the lecture. Winding systems and magnetic circuits are often crucial aspects of electromagnetic design although mechanical and thermal aspects too play a role. Physical phenomena and principles governing the design features are highlighted. Recent computer aided design (CAD) tools that facilitate elegant design of specific*

machines are presented along with some advanced techniques such as Finite Element (FE) methods based on 'Field' equations.

Lecture-4:

Title: Recent Trends in Adjustable Speed Drives:

***Abstract:** Adjustable speed drives have undergone dramatic changes in recent years as they combine motors, power electronics and control. In the race between dc and ac drives the latter has stolen the march with induction motor drives in the forefront. Permanent Magnet (PM) and Switched Reluctance (SR) motor drives are adding to the variety combined with new converter topologies. The lecture reviews different types of drives and latest trends to sensitize the audience on exciting things to come. Advances in power electronics and control strategies have facilitated new possibilities with improved performance and efficiency. Both speed and torque control dictated by application becomes paramount. 'Field oriented' and 'direct torque control' are new techniques. With emphasis on energy efficiency and new applications drives need to be suitably re-engineered.*

Lecture-5:

Title: Small and Special Electric Machines:

***Abstract:** Conventional Electric Machines operated by traditional dc and ac supply have been reigning for energy conversion for a long time, typically from a few kW to MW range. However millions of small fractional kW machines for domestic, commercial and industrial applications are produced each year for an engineer to handle. New materials and concepts have led to new machines such as permanent magnet, switched reluctance and linear variety. Energy conservation and renewable energy applications have led to new and high performance machines such as induction generators, PM generators, doubly fed machines etc. The lecture presents this exciting range of energy converters highlighting their operation, analysis, design, control and applications.*