Synopsis Seminar

Seminar Title	: Design and Optimization of Single Current Sensor-based IPMSM Drive for Industry Application
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Venue	: EE401
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Abstract

: An innovative approach to enhance the performance and efficiency of interior permanent magnet synchronous motor (IPMSM) drives is introduced, focusing on two key aspects: maximizing torque per ampere (MTPA) control and addressing challenges in single current sensor (SCS)-based three-phase drives. Firstly, a new MTPA control method is proposed, emphasizing computational efficiency without compromising accuracy. Traditional methods often rely on complex computations or memory-intensive look-up tables to adjust for variations in motor parameters. In contrast, the proposed approach utilizes self-correction of parameters equivalent base current to calculate MTPA current references in real-time, even in the presence of flux linkage and inductance variations due to temperature or magnetic saturation.
Again, the study addresses issues inherent in SCS-based IPMSM drives with MTPA control, particularly focusing on minimizing current sampling errors that can lead to speed fluctuations and torque ripple during IPMSM's wide range of operations, thereby reducing overall efficiency. A novel model-based sampling error compensation scheme is introduced, incorporating techniques such as rotor angle compensation and dead-time effect mitigation. By reducing current reconstruction errors, this scheme enhances drive performance without imposing a significant computational burden on the controller.
Furthermore, a dead zone compensation technique is proposed to enable improved current sampling, along with the integration of space vector modulation, which enables a significant increase in dc link voltage utilization. This approach extends the operating range of IPMSM drives and offers additional benefits such as reduced system cost, volume, and complexity. Simulation and experimental results demonstrate the simplicity, effectiveness, and suitability of this method for low-cost industrial applications. It also confirms the efficacy of minimizing sampling errors while maintaining computational efficiency, highlighting the potential of these drives for cost-effective and efficient applications in electric vehicles and industrial motor drives.