Synopsis Seminar

Seminar Title	: Performance Improvement of DTC-based Induction Motor Using Adaptive and Predictive Control Techniques
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Venue	: EE401
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Abstract	: In the rapidly evolving field of electrical drives, there is an increasing demand for methods of effective and precise control. This dissertation describes the development and enhancements of DTC methods with the purpose of improving the performance of IM. The major issues that are considered here include computational complexity and disturbance rejection. The thesis first introduces an AFSM controller that is used in DTC to improve the performance of the torque, speed, and stator current. In the method proposed here, adaptive fuzzy logic is used to refine the control strategy in AFSM-DTC and hence succeeds in achieving tremendous performance improvements. The thesis presents the basis for more sophisticated control methods and emphasizes the first approaches towards optimal control in a dynamic environment. Afterward, the AFSM-DTC framework is extended with the introduction of the NNPDTFC approach incorporating PSO to enhance predictive control with neural networks for improvement of transient response and reduction of settling time and ripples. The laboratory implementation with a low-cost DSP controller embodies the NNPDTFC method in this process. The final outcome of the research is a design involving neural network predictive control aspects, based on an ant colony optimization algorithm. The technique consists of ant colony optimization to fine-tune the parameters of the neural network so that a robust and effective control system can be achieved. Finally, the thesis presents FBL-based DTC approach with MPIC technique with linear model. This method applies FBL to decouple torque and flux components and therefore activates the SVM-based two-level inverter-fed IM drive. The Stability analysis confirms the monotonic convergence of the given control law for ensuring robust and flexible operation. The feasibility and effectiveness of these approaches are further supported by extensive MATLAB/Simulink simulations and low-cost DSP2812 experimental validations. Each control strategy will be implemented with rigorous simulation and real-time tests to validate performance improvements and robustness. These below implementations illustrate the practical applicability of the proposed methods, hence making sure that the theoretical advancements translate effectively into real-world applications.