POWER ELECTRONICS & POWER SYSTEM

2026 - 2027

TITLE & ABSTRACT

Advanced Academic Final Year Projects

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Feature Engineering for the Diagnosis of Incipient Stator Faults in Three-Phase Induction Motors

This project develops a MATLAB/Simulink-based system for early diagnosis of stator faults in three-phase induction motors. Motor current, voltage, and other electrical signals are collected under healthy and faulty operating conditions. Feature engineering techniques are applied to extract meaningful time-domain and frequency-domain fault indicators. Machine learning algorithms classify the motor condition and identify incipient stator faults. The system supports predictive maintenance and improves the reliability of industrial motor drives.

Duty Ratio Based Model Predictive Flux Control With Direct Switching-State Selection for Induction Motor Drives

This project develops a model predictive flux control strategy for induction motor drives using MATLAB/Simulink. Motor flux, torque, current, and speed are continuously monitored for controller operation. The proposed method calculates the suitable duty ratio and directly selects switching states to control motor performance. Simulation results are analyzed under different speed and load conditions. The system aims to reduce torque ripple and improve dynamic response and drive efficiency.

Integral Hierarchical Degradation Management-Oriented Control of Parallel-Connected DC/DC Converters

This project develops a control strategy for parallel-connected DC/DC converters using MATLAB/Simulink. The system monitors converter voltage, current, power, and operating conditions to identify degradation effects. Hierarchical control coordinates multiple converter units and manages their contribution to the overall load. Fault or performance degradation in individual converters can be considered during power sharing. The approach improves converter reliability, stability, and overall system lifetime.

Analyzing Spatially and Temporally Coordinated Cyberattacks in Cyber-Physical Systems

This project develops a MATLAB/Simulink and TrueTime-based cyber-physical power-system simulation environment. IEEE bus system models are used to study coordinated cyberattacks affecting power-system measurements and control operations. Attack scenarios are introduced with different spatial locations and timing patterns. System voltage, current, frequency, power flow, and stability responses are analyzed. The project helps evaluate the impact of coordinated attacks and improve power-system resilience.

Reliability Diagnosis and Fault Prediction Technique for Three-Phase Inverters Using Artificial Neural Networks

This project develops an ANN-based inverter fault diagnosis system using MATLAB/Simulink. Three-phase inverter voltage and current signals are monitored under healthy and different fault conditions. Signal features are extracted and provided to an artificial neural network for fault classification and prediction. The system evaluates the performance of the trained model under different operating conditions. It supports predictive maintenance and improves the reliability of power electronic converters.

A Novel Improved Voltage Gain and Reduced Voltage Stress Unidirectional DC/DC Converter for Electric Vehicle Battery Charging System

This project designs and simulates an improved unidirectional DC/DC converter for electric vehicle battery charging. MATLAB/Simulink is used to model the converter, battery, switching circuit, and control system. The converter is designed to achieve higher voltage gain while reducing voltage stress on semiconductor components. Charging voltage, current, efficiency, and output ripple are evaluated under different conditions. The system aims to provide efficient and reliable power conversion for EV charging applications.

Artificial Neural Network-Based Adaptive Voltage Control of a Hybrid Zeta DC/DC Converter

This project develops an ANN-based adaptive voltage controller for a hybrid Zeta DC/DC converter using MATLAB/Simulink. The converter output voltage is continuously monitored under varying input and load conditions. Multilayer perceptron and radial basis function networks are trained to generate suitable control responses. The proposed controller is compared with conventional control methods based on voltage regulation and transient performance. The system improves voltage stability and dynamic response of the converter.

ARM-Powered Chaotic PWM: A Simplified Solution for EMI Reduction in High-Gain DC-DC Converters

This project develops a chaotic PWM-based switching technique for reducing electromagnetic interference in high-gain DC/DC converters. MATLAB/Simulink is used to model the converter and generate conventional and chaotic switching signals. The spread-spectrum behavior of chaotic PWM reduces concentrated switching harmonics. EMI-related frequency components are analyzed using FFT and spectral measurements. The proposed approach aims to improve electromagnetic compatibility while maintaining converter performance.

Hybrid Metaheuristic Optimization for Real-Time Tuning of Extended PID Controllers for DC-DC Buck Converter

This project develops an optimized PID control system for a DC/DC buck converter using MATLAB/Simulink. Converter voltage and current responses are analyzed under input and load variations. Metaheuristic optimization techniques are used to tune PID parameters for improved transient response and steady-state accuracy. Performance is compared using rise time, settling time, overshoot, and voltage error. The system provides an efficient approach for automatic controller parameter optimization.

Back Flash Overvoltage Damages All DC/AC Converters in Photovoltaic Systems

This project analyzes the effect of back-flash overvoltage on DC/DC and DC/AC converters in photovoltaic systems. A PV system with converters, inverter, grid, and protection components is modeled using MATLAB/Simulink. Lightning-related overvoltage conditions are introduced to study electrical stress on converter components. Voltage, current, switching device stress, and system stability are monitored. The project helps identify protection requirements for improving PV converter reliability.

Advanced Intelligent Controllers Design and Simulation Analysis for Optimizing Speed Control of Autonomous Systems

This project develops intelligent speed-control strategies for autonomous systems using MATLAB/Simulink. Motor speed, torque, current, and reference signals are monitored during different operating conditions. Intelligent controllers such as fuzzy logic, neural networks, or adaptive controllers can be designed and compared. Controller performance is evaluated based on tracking accuracy, response time, and disturbance rejection. The system aims to provide stable and responsive speed control for autonomous applications.

Experimental Aortic Pressure Control Using P/PI Controllers With a Comparative Study of MPC

This project develops a control-system simulation for maintaining a desired aortic pressure using P and PI controllers. MATLAB/Simulink is used to model the pressure response and controller behavior. Different controller parameters are tested under changes in system conditions and disturbances. Model Predictive Control can also be implemented for comparison with conventional controllers. Performance is evaluated using settling time, steady-state error, overshoot, and tracking accuracy.

Holo-Current Spectrum: A Novel Non-Invasive Detection Method of Misalignment and Rub-Impact Faults in Three-Phase Induction Motor

This project develops a non-invasive induction motor fault detection system using motor current signature analysis. MATLAB is used to process motor current signals collected under healthy, misalignment, and rub-impact conditions. Frequency-domain analysis and feature extraction are applied to identify fault-related current components. Classification techniques can distinguish different mechanical fault conditions without additional mechanical sensors. The system provides a cost-effective approach for online motor condition monitoring.

Fault-Tolerant Control Strategies for Switching Motor Stator Windings Under Single Phasing

This project develops a fault-tolerant control strategy for induction motor drives operating under single-phasing conditions. MATLAB/Simulink is used to model the motor, inverter, stator windings, and control system. Fault conditions are introduced to analyze changes in motor current, torque, speed, and temperature-related parameters. A fault-tolerant controller modifies the switching or control strategy to maintain motor operation. The system improves motor availability and reduces the impact of stator winding faults.

An Optimal Design Framework for Pole-Changing Induction Motors

This project develops an optimal design and simulation framework for pole-changing induction motors using MATLAB/Simulink. Different pole configurations are analyzed to achieve multiple operating speeds from a single motor. Motor speed, torque, current, efficiency, and electromagnetic characteristics are evaluated for different configurations. Optimization techniques can be used to identify suitable operating parameters. The system supports efficient motor design for applications requiring multiple speed ranges.

Comparative Simulation Study of Luenberger and MRAS Observers for a Sensorless Induction Motor Drive

This project develops a sensorless induction motor drive using Luenberger and MRAS observers in MATLAB/Simulink. The observers estimate motor speed and other state variables without using a mechanical speed sensor. A five-level NPC inverter and advanced motor control strategy are included in the simulation model. Observer accuracy is evaluated under different speed, load, and disturbance conditions. The comparison identifies the suitable observer for reliable sensorless induction motor operation.

Hybrid Multi-Vector Model Predictive Flux Control for Open Winding Induction Motor

This project develops a hybrid multi-vector model predictive flux control strategy for an open-winding induction motor. MATLAB/Simulink is used to model the motor, converter topology, predictive controller, and switching system. Multiple voltage vectors are evaluated to obtain accurate flux and torque control. Motor current, electromagnetic torque, flux trajectory, and speed responses are analyzed. The proposed method aims to reduce torque ripple and improve dynamic performance.

Predictive Control Techniques for Switched Reluctance Motor: An Overview

This project studies and implements predictive control techniques for switched reluctance motors using MATLAB/Simulink. The motor model is developed with appropriate converter and control circuits. Predictive control methods are evaluated for torque regulation, current control, speed tracking, and ripple reduction. Different operating conditions and load variations are simulated to compare controller performance. The project provides an analytical framework for improving switched reluctance motor drive operation.

Online Temperature Estimation of Three-Phase SCIM Using Low-Order LPTN Model

This project develops an online temperature estimation system for a three-phase squirrel-cage induction motor. MATLAB/Simulink is used to model the motor's thermal behavior using a low-order lumped-parameter thermal network. Electrical operating parameters such as current, speed, and load are used to estimate motor temperature. The estimated temperature is compared with reference or measured values for validation. The system supports thermal monitoring and prevents overheating-related motor failures.

Discontinuous SVPWM-Based Speed Control of Unsymmetrical Two-Phase Induction Motor Using a Multifunctional Drive System

This project develops a speed-control system for an unsymmetrical two-phase induction motor using discontinuous space vector PWM. MATLAB/Simulink is used to model the motor, inverter, SVPWM generation, and speed controller. The controller regulates motor speed under different reference and load conditions. Voltage, current, torque, speed, and switching waveforms are analyzed to evaluate performance. The system aims to improve drive efficiency, speed response, and switching performance.

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