

Nikunj Gupta

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EDUCATION

Master of Science (Thesis), Electrical Engineering

Aug 2022 - Jul 2024

North Carolina State University, Raleigh, NC, US

GPA: 4/4

Relevant Coursework: Modeling and Digital Control of Power Converters | Dynamics and Control of Electric Machines | System Control Engineering | Power Electronics | Digital Signal Processing

Bachelor of Technology, Electronics and Communication Engineering

Aug 2014 - May 2018

Indian Institute of Space Science and Technology, Kerala, India

GPA: 8.76/10

PROFESSIONAL EXPERIENCE

Research Assistant, FREEDM Systems Center, US

Jan 2023 – Present

- Designed and implemented **robust motor control** algorithms, such as two degree-of-freedom (2DoF), for Switched Reluctance Machines (SRM) to enhance tracking performance and minimize torque ripple under parameter variations.
- Established and configured a **dynamometer test bench**; utilizing the position, current and voltage sensors.
- Developed control code in **embedded C** for TI 28379D microcontroller and utilized peripherals such as **PWM**, **ADC** and interrupt service routines (ISRs) to ensure precise timing and generation of control signals.
- Analytically verified the impact of controller bandwidth, parameter estimation and system delays on **stability** and performance.

Mechatronics and Control Systems Intern, Nexteer Automotive, US

May 2023 – Aug 2023

- Designed and implemented a novel Model Predictive Control (MPC) algorithm with Integral action for a 12V SRM in an **automotive steering application**, eliminating steady-state error and achieving a **26% reduction in command tracking error**.
- Developed Simulink models and utilized **auto-code generation tools** to run the control algorithm on dSPACE firmware.
- Leveraged **rapid prototyping methodologies** for real-time execution of various control strategies on a dynamometer, and post-processed the experimental data in MATLAB.

Scientist/Engineer, Indian Space Research Organization (ISRO), India

Aug 2018 – Jul 2022

- Conducted **performance validation** of aerospace electromechanical actuators and identification of system parameters.
- Established and configured a test bed for testing and debugging of **aerospace-grade embedded checkout computer**; and devised strategies for testing of firmware and various **communication interfaces** such as RS485, Ethernet and Telemetry.
- Performed **mission-critical operations** on launch vehicle avionics sub-assemblies; streamlined the testing process through the development of automation sequences, resulting in a **30% reduction in testing time** and eliminating user operational error.

ACADEMIC PROJECTS

Modeling and Decoupled Control of Series-Connected Split-Phase Synchronous Machines with Open-Circuit Fault

- Developed a model for **field-oriented control** of a split-phase PMSM in Simulink utilizing sinusoidal modulation technique.
- Experimentally verified the speed control of two series-connected PMSMs driven by a single six-phase inverter, by developing the **motor control firmware** on the TI F28335S microcontroller.
- Collaborated with other researchers and published the results as first author in **IEEE Transactions on Industry Applications**. [\[link\]](#)

Control Design and Implementation for a Half-bridge Series Resonant Converter

- Developed a **switching model** of the converter using **SimScape** in Simulink incorporating losses from component datasheets.
- Designed a voltage compensator using **frequency response analysis** to meet the desired gain and phase margin requirements.
- Implemented **C-code** for the control algorithm on a TI F28379D MCU; and validated the closed-loop control performance under critical operating conditions, achieving a maximum output **settling time of 10ms**.

Control Software-in-Loop (SIL) Validation of a Grid Connected Voltage Source Inverter

- Utilized **droop equations** for voltage and frequency regulation of a grid-forming inverter and simulated the system in Simulink.
- Implemented **space vector PWM** to generate modulation signals and **Stateflow** to implement a Finite State Machine (FSM).
- Developed **C-code** utilizing **object-oriented programming** and integrated the code to Simulink for **software-in-loop** testing of the converter utilizing the UNIFI SIL wrapper library.

Design, Simulation and Control of a Multi-Output Flyback DC/DC Converter

- Conducted **trade-off studies** for selection of MOSFETs/Diodes and reactive components to meet **92% converter efficiency**.
- Designed and simulated the converter in PLECS, incorporating losses from component data sheets and verified the operation.
- Designed a **lead-lag compensator using frequency response analysis**, and validated the control performance in PLECS, achieving 10% maximum overshoot and 20ms settling time.

TECHNICAL SKILLS

Software & Programming

MATLAB, Simulink, Embedded C, C++, LTspice, PLECS, Code Composer Studio

MCU & Processors

TI C2000 MCU series, dSPACE, ARM Cortex-A8

Lab Equipment

Dynamometer test bench, Oscilloscope, DMM, SMPS, Electronic Load