2020/2024

ENGINEERING PORTFOLIO

NIGEL TAN JIN CHUN

BACHELOR OF ELECTRICAL AND COMPUTER SYSTEMS ENGINEERING

Tan Jin Chun - Monash Project Portfolio

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Summary

As a final year Electrical and Computer System Engineering student at Monash University Malaysia, I have a deep interest in creating impactful software and hardware solutions. My curiosity extends beyond my main discipline, making me a well-rounded team player. I'm looking forward to using these skills and perspective to contribute to your team while fully realizing my potential.

Engineering Projects

Final Year Project
Real-Time Implementation for On-Load Tap Changer (OLTC) Tranformer Operation using Typhoon HIL

- Developed a high-fidelity real-time simulation model for the OLTC transformer using the Typhoon HIL platform, focusing on capturing the dynamic behaviour and response to variable load conditions.
- Analyzed the impact of OLTC operations on voltage regulation and power system stability within a modeled power distribution network, identifying potential improvements in efficiency and reliability.
- Implemented and validated the OLTC transformer model within a real-time simulation environment, utilizing the Typhoon HIL software to ensure accuracy and performance alignment with actual operational conditions.

Engineering Integrated Design
Monash Malaysia Color Bowl 2023

- Engineered a self-sufficient autonomous robot capable of detecting and moving colored pucks to displace bowling pins using a flicking mechanism, responding to color signals for targeted actions within a designated playing field.
- Integrated advanced sensor technology, including ultrasonic modules for navigation and obstacle avoidance, color sensors for puck detection, and Bluetooth communication for receiving and executing commands from a host.
- Developed a robust design strategy incorporating durability with lightweight construction, a precision flicking mechanism for targeted pin displacement, and an adaptive pathfinding algorithm to navigate efficiently across different levels of the competition.

Control System Design
System Identification and Control for a Cruise Control System Design

- Created a mathematical model for a cruise control system to maintain vehicle speed under varying conditions.
- Designed controllers to handle speed and incline changes with high precision and minimal error.
- Refined the system through iterative testing, optimizing PID controller settings for stability and responsiveness.

Engineering Electromagnetics
Electromagnetic Brewing: Unpacking xBloom's Solid-State Pouring Technology

- Investigated xBloom's innovative coffee machine, employing MATLAB simulations to understand the electric field's influence on water stream deflection during the brewing process.
- Explored the electrohydrodynamics (EHD) and dielectrophoresis effects in fluid manipulation, contributing to the machine's ability to mimic a barista's precise pouring technique.
- Analyzed the impact of electrode voltage and spacing on the water molecule's movement, revealing the significance of electric field strength in the device's functionality.

Analogue Electronics
Digital Controlled Oscillator for Piano Synthesizer

- Led the design of a digital controlled oscillator for a piano synthesizer, focusing on sound quality and minimal frequency distortion with cost-effective components.
- Engineered complex circuits including RC tank circuits and class AB amplifiers, incorporating microcontroller-based frequency control for precise audio output.
- Executed simulations and tests to optimize synthesizer performance, achieving below 0.3% distortion and stable audio output through advanced noise reduction techniques.

Electrical Energy Systems and Power System Analysis
Lab Reports

- Studied various types of electrical machines including DC, induction, and synchronous motors, focusing on their applications in fixed and variable speed operations. Gained insights into thyristor rectifiers and switched power converters for efficient electrical energy conversion and motor control.
- Explored the intricacies of AC networks, power factor correction, and the comprehensive structure of power generation, transmission, and distribution systems, with a strong emphasis on three-phase transformers and transmission line modeling.
- Developed a solid foundation in analyzing electric power systems using mathematical models of generators, transformers, and transmission lines. Mastered analytical tools for assessing system behavior in steady state and during faults, including power flow analysis and system stability under various conditions.

Digital Systems and Computer Systems
FSM-Based BCD Counter Design and Optimization Project

- Mastered modern logic design techniques and computer architecture, focusing on combinational logic, finite state machines, and microprocessor systems through extensive laboratory practice.
- Developed proficiency in implementing and testing digital circuits using essential components like registers, counters, and programmable logic devices, applying hardware description languages for synthesis.
- Acquired knowledge in interfacing techniques and communication protocols such as RS232, CAN bus, and i2C, alongside foundational concepts in real-time systems and process scheduling.

Information and Networks
Downsampling Research Project

- Conducted in-depth analysis of audio and image downsampling effects, using MATLAB simulations to highlight audio aliasing and the importance of Anti-Aliasing Filter (AAF) techniques.
- Experimented with various methods, determining the most effective approaches for maintaining optimal audio/image integrity, especially under higher downsampling rates.
- Acquired comprehensive knowledge of the technologies and architectures underpinning modern telecommunications systems, including digital signal representation, multiplexing, and modulation.

Electrical Circuits
Lab Reports

- Mastered the fundamentals of linear electronic circuit analysis and design, including sinusoidal steady-state analysis with phasors and complex impedances. Developed proficiency in utilizing state-of-the-art prototyping and measurement tools for circuit design and analysis.
- Gained in-depth knowledge of solid-state electronics, focusing on diodes, field-effect transistors (FET), bipolar junction transistors (BJT) and operational amplifiers, applying these components in practical circuit designs.
- Strengthened understanding of circuit theory through node and mesh analysis, simulation, and AC analysis using Laplace transform techniques for frequency and time response in electrical networks.

Algorithms and Programming Fundamentals in Python
Sudoku Solver

- Acquired foundational skills in Python programming, focusing on program design, algorithm implementation, and solving simple problems through effective use of control structures and data types.
- Developed proficiency in basic input/output operations, modular program structure, and essential data structures to enhance code modularity and maintainability.
- Explored problem-solving strategies including iteration, recursion, and algorithm efficiency, gaining insights into the limitations and capabilities of various algorithms.

Probability Models in Engineering
Statistical Modelling of Covid-19 Patients and Public Transportation

- Mastered core principles of probability theory, including conditional probability, independence, and combinatorics, enhancing my ability to apply these concepts to engineering problems with both intuitive and mathematical approaches.
- Gained a deep understanding of discrete and continuous random variables, exploring common distributions like Gaussian, Exponential, Chi-square, and Rayleigh, crucial for applications in diverse engineering fields.
- Studied advanced topics such as transform methods, limit theorems, and Markov chains, applying these to real-world engineering scenarios like wireless communications, queuing theory, image processing, and electrical insulation.

Signals and Systems
Advanced Gait Analysis using MATLAB

- Conducted in-depth analysis of audio and image downsampling effects, using MATLAB simulations to highlight audio aliasing and the importance of Anti-Aliasing Filter (AAF) techniques.
- Experimented with various methods, determining the most effective approaches for maintaining optimal audio/image integrity, especially under higher downsampling rates.
- Developed foundational skills in electrical engineering with a focus on control, signal processing, and communications, mastering concepts of continuous and discrete-time signals, complex numbers, Fourier series, and transforms.

Leadership and Innovation
Hybrid Solar Lighting System

- Directed a 5-member team in pioneering a solar hybrid lighting system, integrating the innovative Kanawa Tsugi concept and TRIZ (Theory of Inventive Problem Solving).
- Collaborated closely with Germany-based Professor Eckert for expert guidance, culminating in a prototype's successful construction.
- Proud nominee of the esteemed James Dyson Award 2021.