Research Topics

This page provides outline descriptions of (ENGEN582/Masters/PhD) research topics that I currently have available.

A 900-level (PhD) project typically requires about 7000 hours, typically 3 and a half years full-time, or 7 years half-time. An ME project (500-level) will take about 2000 hours, and must be completed in one calendar year. A Capstone project (400-level) requires 450 hours. A Special Topic project (equivalent to a 300-level) typically requires 150 hours. An internship project demands 10 to 12 working weeks, or about 400 hours.

Projects do not come with any stipend or salary unless specifically stated otherwise.

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- **Prediction of State-of-Charge in Rechargeable Batteries using a CPE Model**

  This is a 900-level (PhD) project. Applicants for PhD should have a research masters.

  We have recently shown that a battery may be modelled essentially by a fractional-derivative capacitor or "Constant Phase Element". While the model matches V(Q) data, complex impedance, and recovery transients from current pulses, the ultimate aim is to predict remaining available energy.

- **Low Distortion Circuit Design**

  This could be a 500-level (45-point Honours) investigation or a 500-level (Masters) project

  The ETI480 50W power amplifier served musicians and hifi aficionados for decades. Amongst its elegant design innovations was a nested loop around Sziklai pairs as the output current-gain stage. This project will answer the questions "is linearity better overall using Sziklai pairs compared to Darlington pairs?" and "is linearity better overall with a nested loop around the power output stage?"

- **Audio Frequency Power Meter**

  This could be a 500-level (45-point Honours) investigation or a Special Topics project.

  The aim of this project is to build a power meter that measures real and reactive power
in the audio frequency range. The expectation is to design a version of an ETI-138 Audio Power Meter (Nov 1978) using an AD633 multiplier from Analog Devices.

- **SPICE Model of a BC547**

  This could be a 500-level (45-point Honours) investigation or a 500-level (Masters) project.

  The BC547 has been around a long time. A detailed SPICE model has been available for over 40 years, but the values do not seem to be consistent over time. This is likely to be a result of changes in the silicon fab technology. This project aims to obtain values on a single transistor for the majority of the SPICE parameters. A point of interest will be comparing them with values obtained in the 1970s.

- **Vacuum-tube Characterisation System**

  This could be a 500-level (45-point Honours) investigation or a Masters project,

  The task is to assemble two programmable power supplies into a system for characterising vacuum triodes, and then measure some tube characteristics with a view to testing various available models on precise, modern data. The task is to control the system with a small controller, such as a Raspberry Pi, using USB and RS232 interfaces, and deliver compact data files.