Architecture of the Future Low-Carbon, Resilient, Electrical Power System

Future Architecture of the Network (FAN) – Te Whatunga Hiko

Workstream 1 – Proposed Summer Project

Project title: Efficiency of AC-DC and DC-DC converters (2 Students)

Relevant Workstream(s): WS 1
This project is offered to help in the ongoing research in the Future Architecture of Network (FAN) programme, where the benefit, design and analysis of DC electricity grids are explored. The FAN project is a 7-year, New Zealand wide research program led by the University of Canterbury. The project is broken into five workstream, where this summer student project is a part of Workstream 1, which is the development of fast and accurate numerical analysis tools to simulate large-scale hybrid AC/DC grids, such as for Power-Flow Analysis, Fault Analysis, Harmonic Analysis, Transient Stability, and Electromagnetic Transients. Also, WS1 proposes a future architecture of the hybrid AC/DC, which will be the focus of this project.

Project Description:
DC grids require efficient DC-DC and AC-DC converters. These are necessary to connect DC devices like electric vehicles, batteries and photovoltaics to a DC grid, and to supply AC loads. We want you to establish the efficiency of these converters.

The project begins with obtaining name plate efficiencies for several commercially available converter types. Then simulate how these efficiencies change based on differing operating conditions and design considerations. You will use a time-domain simulation software, such as LTSpice, to model each converter type.

This project is split into two student projects. One student will analyse AC-DC converters, while the other analyses DC-DC converters. Converter size will be kept to low voltage applications (< 1 kV). The converter types to be analysed are:

- DC-DC include buck, boost, buck-boost and dual active bridge.
- AC-DC include uncontrolled rectifier, flyback, two-level converter.

Successful students will gain valuable skills in power electronics modelling and control with experience in simulation tools like LTSpice.

Specific requirements:

- BE(Hons) - Electrical and Electronic Engineering (EEE) student- Second, Third or Fourth year student.
- Good knowledge of power system grids and power electronics.
- Experience with programming languages, e.g. Python, MATLAB and Simulink.
- Some familiarity with simulation tools like LTSpice or PSCAD/EMTDC.
- Excellent academic track record.
- High proficiency in written and spoken English
- Enthusiastic applicants (any nationality) that want to make a positive impact in the world and can work in a collaborative environment

Potential Supervisor(s) – could be confirmed later: Josh Schipper, Neville Watson

Based in: University of Canterbury, EPECentre