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: Multi frequency scanning methods for Dual Active Bridge (DAB) DC -DC converter

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:
Impedance-based stability analysis calculates the impedance of a connected electrical device, as a function of frequency, and infers the stability of the whole system when connected to the admittance of the grid. Think Nyquist stability criterion with feedback between the grid and the converter.

Calculating impedance requires injecting a signal (either voltage or current) into a simulation model of the converter and simulating the response (current or voltage, respectively). The easiest way to achieve this is to inject a single frequency into the converter at a time. However, faster methods inject multiple frequencies. There is a trade-off between computational efficiency and signal-to-noise ratio. We want you to develop a multi-frequency injection methodology and apply it to a Dual Active Bridge DC-DC converter. This will require good signal processing skills. You will become more familiar with simulation tools like PSCAD/EMTDC, which is a valuable skill in the power engineering industry.

The deliverable from your research will be scripts of your implementation, and a report explaining how it works.

Specific requirements:

- BE(Hons) - Electrical and Electronic Engineering (EEE) student- Third (second Pro) or Fourth (Third Pro) year.
- Good knowledge of power electronics, signal processing and control.
- Experience with programming languages, e.g. Python, MATLAB or Excel.
- Some familiarity with power system simulation tools like Simulink will be helpful.
- 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