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: Fault data extraction for hybrid AC/DC grids simulated in PSCAD using Python

Relevant Workstream(s): WS1

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:

Steady state short circuit analysis methods are often inadequate to estimate fault levels for AC/DC grids due to their inability to incorporate converter control. Hence, Electromagnetic transient (EMT) time domain simulation tools are used to better estimate fault levels and fault contributions of each source. PSCAD is widely regarded as the industry-standard for EMT simulations with a wide array of inbuilt models for AC/DC components. Since PSCAD is point of wave type simulator it provides complete waveform state variable; a data conversion is required to express fault currents in quantities needed for rating components within the network. Hence, this project requires you to automate the post processing of PSCAD fault current results through the Python API (Application Programming Interface). The project contains the following tasks:

1. Loading an existing PSCAD project containing AC/DC sources.
2. Introducing faults at various locations and at different time intervals leveraging functions from PSCAD's automation library.
3. After acquiring appropriate data from the simulation, post processing the respective data to determine peak fault current and filter steady fault current.
4. Change the penetration of AC/DC sources through manipulating respective source parameters and observe the change in fault current.

The potential candidate will:

1) Gain hands on experience in automating fault related PSCAD workflows in python.
2) Build understanding of fault levels with respect to various levels of DC equipment penetration.
3) Implement signal processing techniques like Discrete Fourier Transform (DFT) on time series data.

Specific requirements

- BE(Hons) - Electrical and Electronic Engineering (EEE) student, Third or Fourth year.
- Good knowledge of signal processing.
- Experience with power system simulation tools like Simulink will be helpful.

- Good 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: Aprajay Verma, Josh Schipper, Neville Watson.

Based in: University of Canterbury, EPECentre.