Future Architecture of the Network – Te Whatunga Hiko

PhD Project

Project title: Control and Protection Strategies for Multilevel Converter Topologies

This project is focussed on Workstream 3, to enable proliferation of DC grids within AC grids by addressing technologies and control mechanisms for different forms of power electronic converters.

The project will investigate the use of multilevel converter topology for MV grids. This configuration can generate multilevel output voltages without increasing the number of power semiconductor devices and utilizing simpler modulation strategies. To develop a hybrid combination of the existing voltage source inverter concept, a multilevel matrix converter topology is considered important because it will help to control the devices as well as to effectively address the protection systems.

During normal operating conditions, the current multilevel converter designs for MV has operating challenges due to uneven charging and discharging of the DC link capacitors, particularly when the output terminal is connected to the mid-point of the DC link. Additionally, under grid fault situation, the sum of the output phase currents is not zero. For converters, the average neutral point current over each switching period must be zero to ensure the converter generates proper output. Thus, a comprehensive technical feasibility assessment to investigate the operation of the promising multilevel converter topology for MV will need to be undertaken.

The project will develop control methods for the converter that not only are able to relieve the unnecessary voltage stress on the switching devices but also are able to control the neutral point balancing problem over a wide range of voltages, power factors and imbalance currents. Simulations, prototype development and emulations for normal and abnormal grid situations will need to be conducted to assess the performance of the recommended multi-level convertor topologies.

Specific requirement

- A good background knowledge on applicable mathematical analysis methods
- Holds a Bachelor Honours or a master's degree in Electrical Engineering or a closely related field
- Good knowledge of power system grids and power electronics
- Experience with programming languages, e.g. MATLAB
- Familiarity with power system simulation tools e.g. PowerFactory DIgSILENT, 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
- Industrial or practical experience desirable

Based at University of Auckland

Please send you application (CV and a short cover letter/email) to
futurearchitecturenetwork@canterbury.ac.nz