Power Flow and Fault Studies of a Fully Modular DC-DC Converter for Multi-Terminal DC Networks

PROJECT DESCRIPTION

Power electronic converters are key enabling components of the future power system, enabling: 1. Grid integration of renewable energy resources, e.g. wind and solar; 2. Cost-effective and high-efficiency energy conversion between different electrical systems, e.g. DC-to-AC and DC-to-DC conversion; 3. Formation of large DC grids by meshing together many smaller DC network segments; and 4. Construction of mixed (i.e. hybrid) AC-DC power systems.

Recently, the modular multilevel converter (MMC) has gained widespread popularity for DC-to-AC conversion due to the many benefits it provides over traditional voltage-sourced converter topologies. This modular and scalable architecture employs a large number of identical switching cells that are stacked in series to build up to the desired operating voltage, yielding high operating efficiencies and nearly perfect sinusoidal AC output waveforms. The MMC has become the state-of-the-art solution for DC-to-AC conversion in high-voltage and high-power applications, notably for high-voltage DC (HVDC) systems.

In the last few years, a variety of new converter topologies that exploit the MMC concept have emerged. These new MMC-based topologies show significant promise for various power systems applications, such as DC-to-DC conversion in HVDC grids and multiple-input multiple-output converter structures for hybrid AC-DC systems.

The goal of the project is to analyze the power flow capability and fault response of a promising new fully modular dc-dc converter structure that can interconnect multiple dc networks of different voltage levels. This dc-dc converter is seen as an attractive solution for enabling future multiterminal DC power networks due to the converter's highly modular architecture. The project will involve developing a simulation model of a test converter system and carrying out comprehensive simulation case studies. Mathematical modeling may also be required. Students should have a good background in power electronics and a basic understanding of power systems.

FACULTY-DEPARTMENT

Engineering - Electrical and Computer Engineering

DESIRED FIELD OF (STUDENT) STUDY

Power Electronics and Power Systems

Contact: Brendan Cavanagh, Internship Coordinator (Inbound)
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INTERNSHIP LOCATION

University of Alberta Main Campus - Edmonton

NUMBER OF INTERNSHIP POSITIONS

1

INTERNSHIP START DATE

July 4

INTERNSHIP END DATE

October 4

ARE THE DATES FLEXIBLE?

Yes, I am flexible regarding the internship dates. Selected students can contact me to request a date change.

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