Title: Modeling AC/DC and DC/AC converters based on switching function modeling technique

Contact person: Amir Arasteh, amia@dtu.dk

Background:
Power electronic converters can be simulated and analysed using the available circuit simulation software packages like Matlab-Simulink. However, simulation of the internal components of the power electronic converters like diodes or power electronic switches leads to long execution runtimes in complex systems [1]. Additionally, in system level simulations, the behaviour of the converters at their terminals are of interest rather than the detail information about their internal states. Therefore, all internal nodes of the converters can be eliminated as long as their behaviour at the terminal connections are provided. One way to achieve a suited model for this purpose is modelling the power electronic converters based on Switching Function Modeling Technique (SFMT) [1-3].

Content/approach:
The work starts with understanding the operational principle of three phase AC/DC and DC/AC converters and the concept of switching function modelling technique (SFMT). The mathematical equations for modelling the converters based on SFMT will be based on conceptualizing the working principle of the converters and SFMT. The equations are used to control voltage/current sources imitating behaviour of the converters. The result of the model can be validated using a provided benchmark dataset (or model?).

The foremost aim of this works is to familiarize the student(s) with switching function modelling technique and implementation of the model in Matlab. Therefore, very basic model of the AC/DC and DC/AC converter with ideal components is planned. In case there is enough time, a model for back-to-back AC-AC converter can be obtained.

The prospect student(s) need(s) to have a basic knowledge about operating principles of power electronic converters and know how to work with Matlab Simulink.

Deliverables/outcomes:
- Understanding operation principle of AC/DC and DC/AC converters and concept of SFMT
- Deriving equations to model AC/DC and DC/AC converters based on SFMT
- Implementing the derived equations in Matlab
- Documenting the work in a report and giving a presentation about it

Relevant literature: