

# Multi-rate electromagnetic transient simulation of power systems with high penetration of power electronic converters

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## Summary

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*Traditionally, modelling and simulation of large-scale power systems have been conducted using root-mean square (RMS) simulation programs. However, the increased number of converters connected to the grid introduced new dynamic behavior giving rise to new forms of stability problems that cannot be accurately studied using the RMS simulation tools. An alternative to this approach is the use of multi-rate electromagnetic transient (EMT) simulations. The main goal of this PhD research is to investigate the application of multi-rate simulation for stability studies of large-scale power systems having a high penetration of power electronic converters.*

Research field:	Electrical power engineering and mechatronics
Supervisor:	Prof. Dr. Jako Kilter
Availability:	This position is available.
Offered by:	School of Engineering Department of Electrical Power Engineering and Mechatronics
Application deadline:	Applications are accepted between June 01, 2020 00:00 and July 03, 2020 23:59 (Europe/Zurich)

## Description

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Transmission system operators perform power systems studies in order to evaluate, among many other aspects, whether the system is susceptible to any stability problems. Traditionally, modelling and simulation of large-scale power systems have been conducted using root-mean square (RMS) simulation programs. However, the increased number of converters connected to the grid introduced new dynamic behavior giving rise to new forms of stability problems that cannot be accurately studied using the RMS simulation tools. In this case, the typical approach is to rely on EMT simulations which are more accurate but can be computationally expensive and not always feasible for the study of large systems. In order to overcome the shortcomings of these approaches, multi-rate EMT simulations have been proposed. This thesis focuses on the stability analysis of large-scale power systems having a high penetration of power electronic converters using multi-rate EMT simulations. The project aims at understanding how to partition a large-scale power system model using different time steps, evaluating different methods for interfacing the resulting subsystems and determining which component models are appropriate for various types of stability studies.

### Responsibilities and tasks

This is a full time PhD position and student is expected to do research 90% of the time. Other 10% is related to teaching, i.e. supporting lectures and course works in courses related to power system stability, power system optimization and HVDC. Research results shall be presented through publications and presentations. In minimum two journal papers and one conference paper shall be published during PhD studies.

### Qualifications

The applicants should fulfill the following requirements:

- Holds a master's degree in Electrical Engineering or a similar degree with an academic level equivalent to a master's degree
- Have obtained excellent study results and has good understanding on power system analysis
- Have knowledge on power system modeling and electromagnetic transient simulation (EMT)
- Have experience with HVDC converter modelling and stability analysis
- Have experience on using power system simulation and analysis tools such as PSCAD, RSCAD, etc. and programming languages such as C or MATLAB



- Is able to understand, speak and write texts in English language with high proficiency



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