Chair of High-Power Converter Systems
TUM School of Engineering and Design
Technical University of Munich

Opportunities for Talents

Master Thesis

Small-Signal Modelling and Stability Analysis of Grid-Forming Controlled Wind Farms

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Description

The diode-rectifier (DR)-based HVDC transmission system has recently garnered significant attention as a more efficient, reliable, and cost-effective solution for offshore wind farms compared to the voltage source converter (VSC)-based HVDC. Unfortunately, the uncontrolled nature of the DR prevents it from regulating the AC voltage and frequency of the wind farm grid. Consequently, grid-forming (GFM) control for wind turbine converters is necessary to autonomously regulate the AC voltage and frequency.

Despite its advantages, conventional GFM control methods face chanllenges, particularly the issue of power coupling, which can lead to significant power oscillations.This topic focuses on developing small-signal models of GFM controlled wind farms to investigate the underlying coupling mechanism and to conduct stability analyses.

The aforementioned system, issue, and conventional control method can be found in reference:
[1] "Decoupled Distributed Control of Offshore Wind Farms Connected to DR-HVDC Based on Novel Adaptive Virtual Impedance," in IEEE Transactions on Power Electronics.

Tasks

- Conduct an extensive review to understand the background and existing control methods;
- Simulate the conventional GFM control method (guidance and assistance can be provided);
- Develop small-signal models of the system and validate its accuracy through simulations;
- Analyse the coupling mechanism and system stability.

Prerequisites

- Strong understanding of control theory and system modeling;
- Great interest and basic knowledge of power electronics control;
- Proficiency in MATLAB/Simulink or PLECS;

Contact and further information

- Please attach your CV and the latest study transcript to the application

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