Lehrveranstaltungsankündigung

LV 431.314 Ausgewählte Themen der elektrischen Antriebstechnik 2

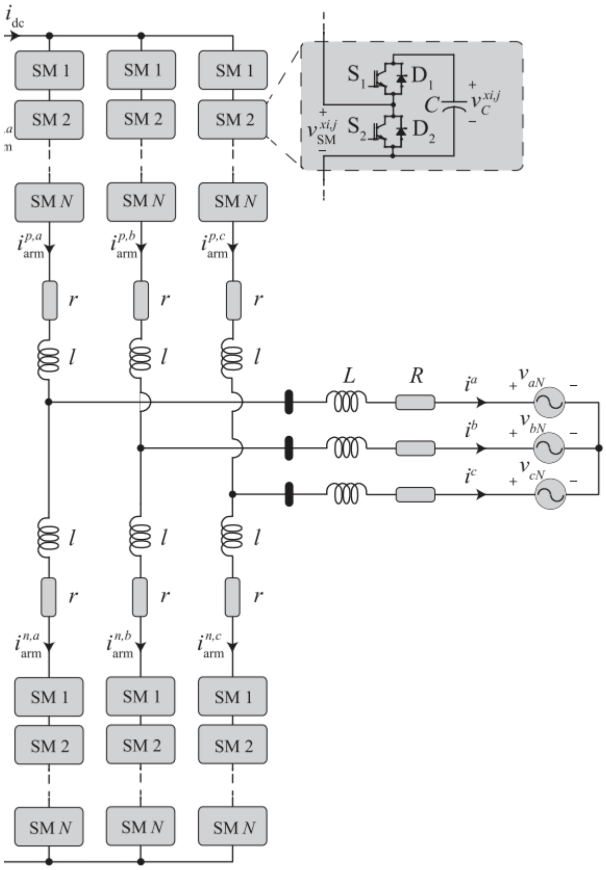
Power System Applications of Power Electronics (VU)

(2SWS/3ECTS)

Instructor

Prof. Maryam Saeedifard received the Ph.D. degree in electrical engineering from the University of Toronto, in 2008. Since January 2014, she has been an assistant professor in the School of Electrical and Computer Engineering at Georgia Institute of Technology. Prior to joining Georgia Tech, she was an assistant professor at Purdue University and a research scientist with the Power Electronic Systems Group, ABB Corporate Research Center, Switzerland. She is the recipient of the Richard M. Bass Award Outstanding Young Power Electronic Engineer Award of the IEEE Power Electronic Society in 2010. Her research interests include power electronics and its applications in power systems and vehicular electrification.

Course description



The continuously increasing demand for electric power and the need for efficient grid integration and transmission of remote large-scale renewable energy resources have revived the interest in High-Voltage Direct Current (HVDC) systems. The HVDC systems based on the Voltage-Sourced Converter (VSC) are a promising technology for (i) expansion of the power networks for large cities, (ii) grid integration of renewable energy resources, i.e., hydropower and offshore wind farms, (iii) long-distance bulk power transmission, (iv) interconnection of asynchronous power grids, and (v) electrification of isolated loads, islands, and oil and gas stations. The key enabling technology for VSC-HVDC systems is efficient, scalable, and fault-tolerant high-power VSCs. The Modular Multilevel Converter (MMC) topology is a newly introduced VSC which, conceptually, does not have the drawbacks of the existing high-power VSCs. This course provides a comprehensive description and overview of the MMC-HVDC systems. This course provides a comprehensive description and review on the most recent advances and contributions on the operational issues, modeling, and control of the MMC-HVDC transmission systems.

Learning outcomes

1. Understand the principles of HVDC transmission systems and their differences with AC transmission.
2. Analyze and model line-commutated converters (LCCs) in the rectifier/inverter modes of operation to construct HVDC transmission systems.
3. Understand the differences among various HVDC transmission configurations
4. Analyze and model voltage-sourced converters (VSCs) in the rectifier/inverter modes of operation to construct HVDC transmission systems.
5. Understand basics of operation, control and operational challenges of the modular multilevel converters (MMCs) for HVDC transmission systems.
6. Develop various control strategies for proper operation of the MMC-HVDC systems.

General Competencies

1. Knowledge of semiconductor devices and control theory.
2. Knowledge of power electronics and basics of operation of inverters/rectifiers.
3. Ability to implement simulation models in the MATLAB/SIMULINK or PSCAD/EMTD software tools.

Course Topics

1. Introduction to HVDC transmission systems and various configurations and components.
2. Analysis and operation of LCC-based HVDC systems, basics of operation of LCCs, control aspects, harmonics, filtering, and faults.
3. Analysis and Operation of voltage-sourced converter (VSC)-based HVDC systems, basics of operation of VSCs, control aspects, harmonics, filtering, and faults.
4. Multilevel VSCs, their basics of operations, salient features and operational challenges.
5. Fundamentals of operation of the state-of-the-art HVDC transmission systems based on Modular Multilevel Converters (MMCs), circuit topologies and submodule configurations, steady-state analysis, and component rating issues
6. Control aspects of the MMC-HVDC systems including internal dynamics, pulse-width modulation techniques and submodule capacitor voltage balancing strategies, circulating current control, and closed-loop current control, and operation under AC and DC faults and unbalanced conditions

References

1. A. Yazdani and R. Iravani, Voltage-Sourced Converters in Power Systems, IEEE Press/ John Wiley, 2009.
2. Conference and Journal Papers

Meeting Times:

Tuesday, 9th May 2017, 10:00h – 16:00h,
Thursday, 11th May 2017, 10:00h – 16:00h
Friday, 12th May 2017, 10:00h – 13:00h
Tuesday, 16th May 2017, 10:00h – 16:00h
Thursday, 18th May 2017. 10:00h – 16:00h
Exam: Friday, 19th May 2017, 10:00h – 12:00h,
All: Library of the EAM (HS01020F)