EPFL

EE-470

Power systems dynamics

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Cursus	Sem.	Type
Electrical and Electronical Engineering	MA2, MA4	Obl.
Energy Management and Sustainability	MA2, MA4	Opt.
Energy minor	E	Obl.

Language of teaching	English
Credits	3
Session	Summer
Semester	Spring
Exam	During the semester
Workload	90h
Weeks	14
Hours	**3 weekly**
Courses	2 weekly
Exercises	1 weekly
Number of positions	

Summary

This course focuses on the dynamic behavior of a power system. It presents the basic definitions, concepts and models for angular stability analysis with reference to transient stability, steady state stability and long term stability.Fundamentals related to voltage stability are introduced as well.

Content

Role of simulation for power systems operation and planningLoad-flow in steady-state balanced three-phase systems: Gauss-Seidel method. Newton-Raphson method. Active-reactive decoupling. Linearized method (DC flow).
Stability and dynamic behavior: Definitions: Steady-state, transient and long-term stability. General model of the power system. Direct methods. Time domain methods: partitioned approach, simultaneous approach, numerical integration methods.
Steady state stability and transient stability: Choice of generator and load models. Classical model of stability. Multi-machines stability. Application: case of one-machine connected to an infinite bus (equal-area criterion). Eigenvalues and eigenvectors applications.
Long-term stability: Simulation of the dynamic behavior of the electric power system at the scale of minutes or several minutes after a disturbance. Modeling: primary and secondary frequency control, generators and loads.
Design and operation of simulation software: Case studies using an industrial simulation software (Eurostag).

Keywords

Load-Flow calculation, steady state - transient - long term stability, direct/time domaine methods, classical model, equal area criterion, primary/secondary frequency control, eigenvalues and eigenvectors.

Learning Prerequisites

Required courses

Electric power systems, Electromecanics, Energy conversion

Learning Outcomes

By the end of the course, the student must be able to:

- Formulate appropriate simulation model according to the nature of the stability under study
- Choose appropriate models of the power system components according to the nature of the stability under study
- Choose appropriate numerical methods
- Interpret the simulation results

Teaching methods

Ex cathedra lectures with exercices and case studies

Expected student activities

attendance at the lectures; completing exercices

Assessment methods

Continuous control

Resources

Bibliography

lecture slides