

EE-588

Advanced lab in electrical energy systems

Hodder André

Cursus	Sem.	Type
Electrical and Electronical Engineering	MA2, MA4	Opt.

Language of teaching	English
Credits	4
Withdrawal	Unauthorized
Session	Summer
Semester	Spring
Exam	During the semester
Workload	120h
Weeks	14
Hours	4 weekly
TP	4 weekly

Number of positions

It is not allowed to withdraw from this subject after the registration deadline.

Summary

The purpose of this teaching lab is to put together all the concepts learned during the course into electrical energy by the implementation of an islanded production unit. The number of places is limited, therefore the student must contact the teacher before the beginning of the course.

Content

The goal of this teaching lab is to follow all the steps for setting-up of an islanded production unit.

The group consists of a direct current machine and of a synchronous machine.

The DC machine is used to model an hydraulic turbine. To do this a speed control will be implemented in a DSP. The whole design will be made such as, the choice of controller type, the type of control, the type of criteria (symmetric or meplat), measurement of small time constants, the controller implementation (C code) , and tests under steady state as well as in transient.

The synchronous machine is used as a generator and commissioning of industrial voltage regulator (Unitrol of ABB) will be made. Will also follow a customization of the coefficients of the control as well as tests in transient and steady state. The group will then be tested on different loads (resistive and capacitive loads and induction machine).

Finally, the different production units will be connected together to create an interconnected islanded network and inherent interconnection/synchronization problems will be addressed.

The following will be studied :

- Modeling of a hydraulic turbine by a DC machine
- Tests on the synchronous machine (determination of the parameters)
- Speed control
- Voltage regulator
- Islanded production unit
- Interconnection of islanded units

During this teaching lab the student is left very free and independent. A "global" order is given but the way forward is not explained and the student must put his skills out to analyze problems and reflect on the paths to follow to reach the goal.

Keywords

- Production unit
- DC machine
- Synchronous machine
- Speed control (DSP)
- Voltage regulator (Unitrol)
- Islanded network
- Interconnection of islanded production units

Learning Prerequisites

Required courses

EE-490(c) Lab in electrical energy systems

Recommended courses

EE-360 Conversion d'énergie

EE-361 Machines électriques (pour EL)

EE-365 Power Electronics

EE-370 Réseaux électriques

Learning Outcomes

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

- Perform an interconnection with other production units
- Analyze problems
- Create a production unit
- Use an industrial voltage regulator
- Perform tests on electrical machine
- Design a speed control
- Test an islanded production unit
- Apply all the knowledge learned as a student in electrical energy

Transversal skills

- Use a work methodology appropriate to the task.
- Set objectives and design an action plan to reach those objectives.
- Demonstrate the capacity for critical thinking

Teaching methods

Practical work in groups

Expected student activities

Attend every session and participate actively

Assessment methods

Obligatory continuous. Lab books are given back for correction during the semester and a final oral examination.

Supervision

Assistants Yes

Resources

Websites

- <http://tplaime.epfl.ch>