

# Homework 5 - Final Assignment

- ✓ This final assignment counts for 50% of the final grade.
- ✓ At the end of the semester each student will present his/her work in class.
- ✓ You may work in groups, but each student should prepare a *separate, original report*, and a unique presentation.
- ✓ Contact me by Email to schedule a personal meeting, until *three weeks before the end of the semester*. In this meeting we will choose the type of assignment and the exact topic you will work on. Please read these instructions carefully, and think of several possible topics before the meeting.

You may choose between two types of assignments:

- ✓ **Option 1: simulation based assignment:** In this type of assignment the objective is to simulate a small power system in Matlab Simulink.
- ✓ **Option 2: research assignment:** In this type of assignment you will research a topic of your choice, in the general field of power system dynamics and control, and based on scientific papers from the recent literature.

## Option 1: simulation based assignment

In this type of assignment the objective is to simulate a small power system in Matlab Simulink. You will use the ideas we studied during the course to implement a simulation that includes the following components:

- ✓ synchronous generators or motors,
- ✓ a photovoltaic inverter
- ✓ power lines
- ✓ loads

During our personal meeting we will decide together what type of simulation to design, and which components should be included. After designing the simulation in Matlab Simulink, you will test your system and compute its steady-state, efficiency, stability, and dynamic response.

## The report

You need to submit a report that shows the system you designed and its typical behavior. The report is limited to 4 pages. Use the following format: page size A4, font size 12, line spacing of 1.2 lines, and margins of 2.5 cm from all sides. Submit the report as a PDF file.

The report should include the following sections:

- ★ **System structure and parameters.** Show a schematic diagram of your system, the dynamic models you used, and a list of parameters.

- ★ **Steady-state analysis.** Show the system's steady-state and efficiency for several different scenarios.
- ★ **Dynamic response.** Include graphs that show the system's transient behavior.
- ★ **Stability analysis.** Show the system's poles and zeros at various operating points.

## The presentation

At the end of the semester each student will present his/her research in class.

Guidelines for preparing the presentation:

- The presentation is limited to 8 slides and 8 minutes.
- Following each presentation there will be time for questions and discussion.
- Create the presentation using Microsoft PowerPoint or a similar software.
- Use a simple template. There is no need for complex animations or special effects.
- Limit the number of words and equations.
- Use a default font size of 24-28, and a larger font size for headers.

General structure of the presentation:

- System structure and parameters
- Steady-state analysis
- Dynamic response
- Stability analysis

## Option 2: research assignment

In this type of assignment you will research a topic of your choice, in the general field of power system dynamics and control, and based on scientific papers from the recent literature. Do not be afraid to take this assignment - the process is fully guided, and is not very hard to do.

The first step is to choose a topic for your research. During our personal meeting, I will give you one or two scientific papers to read. After you read these papers and understand the main ideas they present, we will meet again and formulate a small extension of these ideas, which will be your topic of research.

Once you decide on a specific topic, the second step is to test your research question based on theoretical analysis or computer simulations. The output of this stage may be numeric data in the form of graphs or tables, or even small mathematical theorems. The final step is to conclude your research findings in a concise form.

## The report

The finding of your research should be summarized in a short report. This report is limited to 4 pages. Use the following format: page size A4, font size 12, line spacing of 1.2 lines, and margins of 2.5 cm from all sides. Submit the report as a PDF file.

General structure:

- ★ **Introduction.** The most important part of the introduction is the contribution of the research, which is a short answer to your research question. The contribution appears at the end of the introduction. Before stating it provide the necessary background so that the reader can understand the context, the terms you use, and why the question you chose is significant.
- ★ **Body.** This section includes models, assumptions, theorems, algorithms, etc.
- ★ **Numerical results (optional).** This section shows numerical data in the form of tables, images, or graphs.
- ★ **Conclusions** (Limited to 100 words). Restate the problem you chose in 1-2 sentences. Explain the main ideas of your solution.
- ★ **Bibliography.** In your report you will typically use information from sources such as textbooks, websites, or articles. Include a list of the sources at the end of the report, and cite these sources within the text. 1-3 such sources are enough.

## The presentation

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General structure of the presentation:

- Introduction (1-2 slides)
- Body
- Numerical results (optional)
- Conclusions (1 slide)