Project Proposal

A comparison among different network aggregation methods used for obtaining the equivalent for large power systems

This project will propose a comparison among different static-based network aggregation methods used for obtaining equivalents for in large scale power systems. The project will be carried out at the Electric Power Systems Lab, KTH. Please contact Ebrahim Shayesteh (e-mail: ebrahim.shayesteh@ee.kth.se) for further information.

Background

In many power system studies [1]–[4], in order to simplify the complexity of the simulations resulted from the large size of the power system, a smaller equivalent is first obtained for the system. Then, the considered power system study is performed on the equivalent system rather than the original system. Aggregating methods used for obtaining the equivalent system can be divided into dynamic and static-based groups [2]. In this project, we focus on the static-based group and compare the aggregation techniques of this category for simulation of large scale power systems.

Objectives

The main objective of this project is to compare different static-based aggregation methods for obtaining equivalents for large scale power systems. The purpose of the comparison is to investigate different applications of these aggregation methods. It will also help to determine the accuracy of these methods by calculating the resulting error in their simulations results. To be able to do such evaluation, all considered aggregation methods are applied to the original power system and their corresponding equivalents are obtained. Then, some of important power system problems like Power Flow (PF) and Optimal Power Flow (OPF) are used to simulate the original power system as well as all equivalent systems, obtained via different aggregation techniques. Finally, the simulation results of these equivalents are compared to
the simulation results of the original power system to clarify the application and accuracy of each aggregation method.

Work Plan

The following steps need to be considered for obtaining the desired algorithm:

1- A review on different network aggregation methods for obtaining an equivalent system for large scale power systems should be performed.
2- From the studied methods in step 1, the ones which are related to static network aggregation are selected and simulated using MATLAB.
3- One test case like one of the IEEE test cases should be selected and simulated aggregation methods should be applied to this test system and equivalent system corresponding to each method should be calculated.
4- The student should start working with MATPOWER to learn how to run PF and OPF with this MATLAB toolbox.
5- The simulation results of the original test system and all equivalent systems should be computed. Then, the amount of error between the simulation results of the original system and each of equivalent systems should be calculated.
6- Based on the calculated error for each equivalent system, the accuracies of different equivalent systems are compared.
7- In case we have enough time, we will test all aggregation methods on different test systems to generalize our conclusions.

Prerequisites

It is preferable if the student who wants to participate in this project have completed as many as possible of the following or equivalent courses:

1- EG2050 System Planning
2- EG2021 Power System Analysis
3- EG2110 Power System Stability and Control
4- EG2040 Wind Power Systems
5- EG2060 Electricity Market Analysis

Also, the student can have a solid knowledge of optimization theory since most of the formulation of this project need solving an optimization. Computer programming skills (in particular MATLAB and maybe GAMS) are also very valuable in this project.
References


