

Sujet de stage – Internship Offer

Development and Validation of Power System EMT Models in EMTP

Keywords:

Microgrids, Power System Modeling & Simulation, EMT Models, EMTP, MATLAB/Simulink.

Context:

The development of accurate and reliable power system models is a crucial step in designing and studying the electrical power networks. These models are used to simulate the electrical power networks in many topologies and operating points to study its behavior. Accurate models are needed for reliable simulations and these simulations are a very important tool in the hand of power system operators to help them take the right decision in a timely manner.

In conventional power systems, there are elements such as transformers, cables, motors and generators. Future power systems that include a high penetration of Renewable Energy Sources (RES) require additional element models such as the Photovoltaic, Wind Power plants, Fuel Cells, Ultracapacitors and Batteries models for instance. These systems do not include only electrical equations but also thermal, chemical, mechanical... equations. Models for the different types of power electronic converters that interface that primary energy sources are also required. These materials include also large frequency behavior, and it may be important to into account the maximum of equations.

Regardless of the type of element and the different models that exist to model its behavior, there exist actually many mathematical ways to write the models' dynamic equations which consist of mainly Algebraic and Ordinary Differential Equations (ADE – ODE). The way we chose to simplify these mathematical models –or keep it without simplifications—determines the type of the model, either static-phasor models or dynamic Electromagnetic Transient (EMT) models. The former being the simplest but on the other hand captures the least dynamics while the latter is the most detailed type of models yet it is the most complex and time consuming.

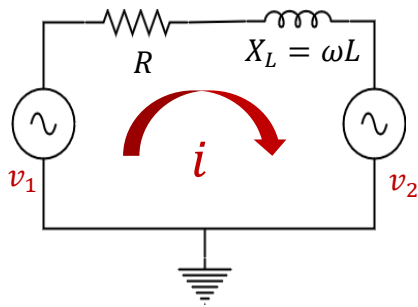


Figure 1: Illustrative Circuit

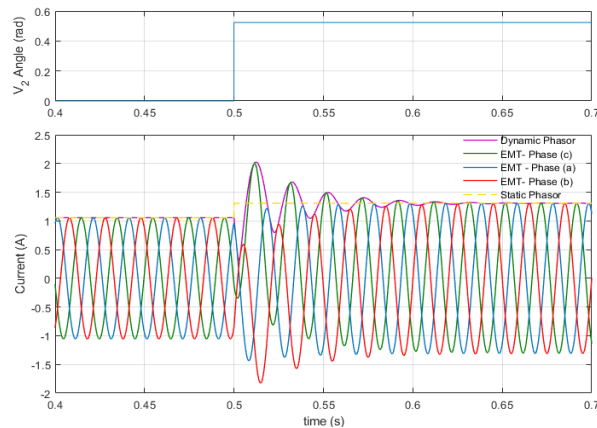


Figure 2: Current representation in case of Phasor and EMT models simulations

Internship Objectives:

This internship aims principally to develop and validate complete microgrids EMT models in EMTP software integrating both conventional elements (Transformers, Lines, Synchronous Generators...etc.) as well as high penetration of RES (PV, Wind, Fuel Cells, Batteries) along with their power electronic converter interfaces. The objective is to validate similar models developed in MATLAB/Simulink using available library of the EMTP software, however, some new developed converter controls in Simulink which does not exist already in EMTP are also required to be validated and compared to the Simulink Environment.

Intern Profile Required:

- You are currently in the last year of your Master/Diplome d'ingenieur with a background on electrical engineering in general and power systems in specific.
- You have a good knowledge of the different elements of the power system and their controls.
- Very good knowledge of Matlab/Simulink.
- A knowledge of EMTP is also expected and appreciated.

Contact :

Jérôme BUIRE : jerome.buire@g2elab.grenoble-inp.fr

Fadi KELADA : fadi.kelada@g2elab.grenoble-inp.fr