Steady State Simulation of a Distributed Power Supplying System Using a Simple Hybrid Time-frequency Model

Dawid Buła, Michał Lewandowski
Silesian University of Technology
dawid.bula@polsl.pl, michal.lewandowski@polsl.pl

Abstract

In modern computer simulation of power systems, two types of models are typically used: time domain models and frequency domain models [2], [4]. Time domain models are usually based on differential equations [2] which provide a good representation of their dynamical behavior and nonlinearities [2], [1], but also require a considerable computing power. This is the main reason why the frequency domain models are often considered [2]. This approach can significantly reduce the required computational effort (algebraic equations instead of differential equations). The main disadvantage of the frequency domain models is the considerable simplification of the models (in case of nonlinear elements usually using Fourier series expansion). The other limitation is the ability to simulate only a steady state of the system at one particular operating point. The best solution would be to combine the accuracy of the time domain modeling with the performance of the frequency domain modeling. This leads directly to a hybrid time-frequency models [3], [5]. The paper presents a hybrid time-frequency model, which is a combination of the models presented in [1]. To simulate the nonlinear part of the system a Simulink time domain model of each nonlinear element is used, while the simulation of the linear part of the system is performed using a frequency domain model of the system applied in PCFLO. A well-designed programming interface allows seamless data exchange between the two environments and provides control over the simulation process. It is shown how the hybrid model compares to the time and frequency domain models [1] using a 20 node power supplying system with nonlinear loads (6-pulse rectifies). The comparison allows to examine the convergence and efficiency of the developed hybrid model and determine the directions for its further improvement.

References

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