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Chapter 1

Introductory Chapter: MATLAB Applications in Power System

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1. Introduction

One of the most widespread simulation software is MathWorks MATLAB/Simulink package [1]. The MathWorks MATLAB allows the user to analyze complex static systems that are to be modeled through "numeric computation and visualization." Also, Simulink allows systems to be simulated dynamically and allows a controller to be modeled with the aid of block diagrams. Moreover, the user is allowed to concentrate on the model, rather than its implementation [2].

The simulation of power engineering applications conventionally can be a challenge for both undergraduate and postgraduate levels [1]. To easy implementation for several kinds of power structure and control structures of power engineering applications, some simulators such as MATLAB/(Simulink and coding) to be necessary—especially for students—to develop and test various circuits and controllers for power engineering, which include all branches in power engineering area [3]. This book includes some chapters to show how to simulate and work with MATLAB software for several MATLAB professional applications of power system engineering. Moreover, this book presents some techniques to simulate power matters in an easy way using the related toolbox existing in the MATLAB/Simulink and teach the simulation in the mentioned area.

2. Summary of second chapter

To facilitate the mentioned goals in Introduction Section , Chapter 2 written by Alexandru Băloi and Adrian Pană proposes a method for network harmonic impedance determination, practically. The network harmonic impedance has been used as a tool to predict the harmonic condition amplifications in the case of reactive power compensation by capacitor banks [4]. Based on the measured network harmonic impedance, a quick method has been developed to

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anticipate the harmonic voltage and current amplifications. Amplification factors have been calculated depending on the equivalent harmonic impedance of the network seen in the compensation bus [5]. A distribution network containing harmonics has been modeled, and then harmonic impedance has been determined in different operating conditions using MATLAB Simulink. Using the measured values and the capacitive reactance of the capacitor bank, the amplification of the harmonic voltages and currents has been estimated by calculus [6, 7]. To validate the method, the obtained results have been compared with the values obtained by simulation after the connection of the capacitor bank to the network. The chapter has proved that the network harmonic impedance is a useful tool to estimate the harmonic amplification caused by power factor correction using shunt capacitor banks.

3. Summary of third chapter

The mentioned goals are followed by Chapter 3, where Anbarasi Jebaselvi and Meenakshi present modeling, simulation and analysis of permanent magnet synchronous generator (PMSG)-based wind energy conversion systems for both open- and closed-loop control strategy [8, 9]. Since the choice of wind turbine generator and optimum power from it can be achieved by matching the load and power lines close to each other [10], maximum power from wind using PMSG has been made possible by using intelligent controllers, namely fuzzy logic controllers. As PMSG suffers from strong decay of magnetic field, which tends to reduce the generated voltage at their stator terminals drastically with load, hence not much suitable for isolated operation and thus the whole analysis has been done with grid connected network. The other major limitation includes loss of flexibility in field flux control, and thus intelligent technique like fuzzy logic mechanism has been attempted along with Space Vector Modulation (SVM) to have a smooth control of field flux and load power management in PMSG. MATLAB Simulink has been used to simulate and analyze the PMSG-based wind energy conversion systems for both open- and closed-loop control strategies [11]. It is confirmed that sufficient revenue could be generated from the proposed model by implementing the same in real-time.

4. Summary of forth chapter

To follow the mentioned goals in Introduction Section, Chapter 4, Chiemela, Onunka and Evans Eshiemogie, Ojo develop and implement a wind-induced high voltage transmission line vibration using finite element method (FEM) in MATLAB to investigate wind-induced vibration. The chapter has focused toward the development of a finite element method and its implementation on the MATLAB software. The developed finite element method (FEM) has been done based on the concept of the simply supported beam model and it has been used in modeling the transverse vibration of power line conductors [12]. First, the FEM model has been used to develop the equation of motion of the power line conductor. In addition, dampers, conditions for damping, and free- and forced vibrations of the overhead conductor

have been considered in the FEM model [13]. Wind-induced experiments have been conducted in the laboratory using an actual overhead power conductor. The developed models have been simulated in the MATLAB computing environment. The results from the MATLAB simulation, finite element, and experimental recordings have been compared in order to determine the accuracy of the models and evaluate the efficacy of models simulated in MATLAB and developed using the FEM. Finally, the developed FEM has been used as the means to verify the effect of varying the conductor axial tension on the natural frequencies of the conductors.

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