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FPGA-BASED HARD CO-SIMULATION OF TYPICAL INDUCTIVE POWER TRANSFER (IPT) SYSTEM

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ABSTRACT

This paper presents a novel approach for the field programmable gate array (FPGA)-based hard co-simulation of typical inductive power transfer (IPT) system. The implemented control algorithm is in an environment of the Spartan-3A/3AN (FPGA) kit board, while the power section and the load are simulated in Matlab/Simulink environment. An applicable example of a direct AC to AC converter, in the power stage, was used to generate a resonance current with high frequency, for inductive power-transfer (IPT) system and discussed in short notes. Such a system is constructed by different natural components such as power converter, different elements and a well-designed control system that requires special and suitable software like Matlab/Simulink software package, which develops the direct AC-AC converter model for the input power side. The proposed control algorithm was implemented based on Spartan-3A / 3AN (FPGA) with an automatically generated VHDL code that was used for the implementation. The software used is the Xilinx System Generator (SysGen) which is a very beneficial toolbox that works in the MATLAB/Simulink environment with a library of several important blocks serving defined functions implemented in the FPGA. It is also possible to convert the implemented model into VHDL code. It is also possible to convert the implemented model into VHDL code. The use of the (SysGen)with its two main advantages over traditional methods, possibility of implementing algorithm matches the function exactly as in the simulation and it is not required to create two different models (one for the simulation and the other for the implementation). The simulation results confirm the accuracy of the proposed control system as well as the feasibility of the overall Spartan-3A/3AN (FPGA) based control circuit.

KEYWORDS: Inductive Power Transfer, AC-AC Direct Converter, Spartan-3A/3AN (FPGA), Xilinx System Generator, Matlab/Simulink.

1. INTRODUCTION

An uncompensated circuit model of IPT system is shown in Fig. 1, which can be considered the most fundamental figure [1].