Co-simulation of Fuzzy Logic Control for a DC–DC Buck Converter in Cascade System

Mohammed Kh. Al-Nussairi & Ramazan Bayindir

Abstract

The multi-converter system has increasingly used in the aerospace ships, sea ships, electric vehicles, and microgrids. The multi-converter is a cascade system of power electronic converter. The second stage is represented as a load to the first stage. At some, the power electronic loads behave as a constant power load. The constant power load makes system under negative damping and unstable situation. The instability effects of constant power loads are caused by incremental negative resistance. This paper introduces the fuzzy logic control to stabilize the DC–DC buck converter, which is the first stage of the cascade system. The second stage has a mixed load (buck converter, constant power load, and resistive load). The function control of fuzzy logic control is regulated the voltage terminals of the DC–DC buck converter. Firstly, the fuzzy logic controller is simulated with the suggested system by using the MATLAB/Simulink environment. Moreover, then the implementing and simulation method of fuzzy logic control by using FPGA-in-the loop (FIL)-based. The simulation environment is MATLAB/Simulink, which is used for building and implementing the behavioral model. The behavioral model has used the Verilog HDL language. The results of this work compared between the simulations of the fuzzy logic toolbox and FIL-based fuzzy logic controller and have the same results have obtained.