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A two switch, high input voltage range power controller topology with oscillation damping

***Abstract**. Proposed paper discusses a construction and characteristics of a switched mode power controller operating as adjustable load controller. Unique converter topology allows high efficiency operation for a wide range of input voltage change. This feature together with a simple construction make it an interesting choice for applications starting with renewable energy sources up to controllable loads for the testing of performance of electric machines. Natural oscillating character of the input is damped using the averaged current measurement concept. Simulation and experimental results are shown and discussed*

Keywords: Power controller, switched mode converter, converter topology, high efficiency.

Introduction

Dynamic behavior of modern power sources, storages, power supplies and electrical machines is crucial for many applications. In order to verify dynamic properties of such systems power electronic converters are sometimes used in configurations described as power electronic loads or ballasts [1, 2]. Passive resistor networks are usually the obvious choice for simple loads even though the load power adjustment is limited and no load regeneration is possible. In case of larger power ranges water or solid resistor networks are sometimes used [3], load regeneration techniques are applied if load power can be reused or supplied back to the power grid. On the other hand the input/output power control is sometimes necessary for maximum power point tracking or output power control in case of renewable energy sources [4]. This paper proposes a topology of switched mode converter operated as power controller in a wide input voltage range. Analytical description is given, because of the system's inherent dual mode of operation (linear and quadratic area of operation) the description and properties vary as the load output voltage increases. Based on the analytical description, simulation analyses and practical results are described and analyzed. Such a system was designed and constructed in the laboratory of power electronics in the Electrical Engineering Department of the West Pomeranian University of Technology. Proposed system topology is presented in Fig. 1.

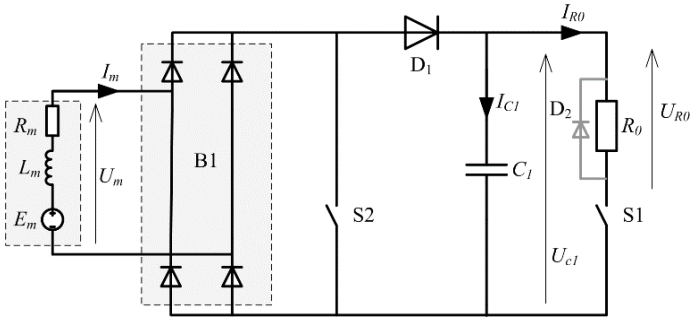

Fig.1. Topology of proposed input/output, switched mode power controller.

Figure 1 shows a direct current machine equivalent circuit as a supply source, considering different types of tested equipment the inductance L_m can to be integrated in the DC link. Depicted example could be implemented using an AC power supply, in case of DC

sources with single voltage polarity input rectifier can be omitted. It is worth to notice that both switches are controlled with respect to system ground.

Basic waveforms and simulation results

Basic electric waveforms are given in Fig. 2.

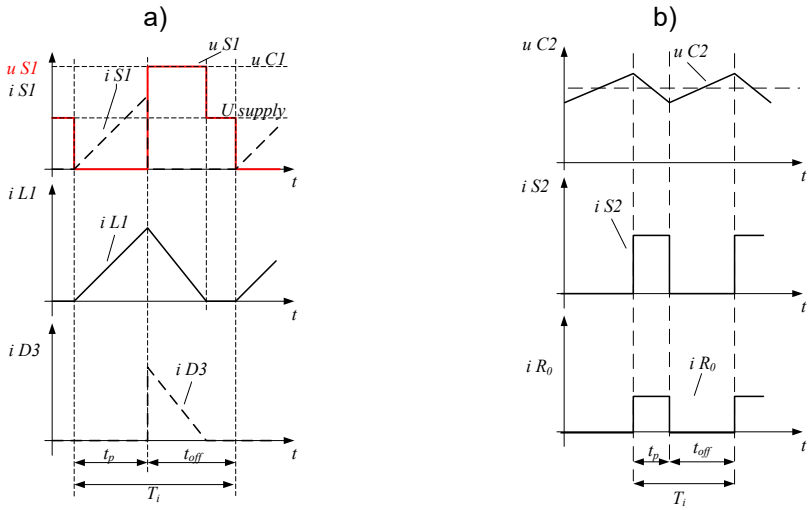

Fig.2. a) basic waveforms for controller for boost operation; b) basic waveforms for buck operation.

In order to verify properties of proposed power electronic load systems simulation models were constructed using the Simplorer and PLECS environments. Both the input current or power can be controlled or the output power of both converters.

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