

Design of Switched-Mode Power Supply Using MATLAB/SIMULINK

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Abstract— The SMPS (switched mode power supply) has been achieved the high performance and high power density by developing the power semiconductor devices such as MOSFET, IGBT, BJT and GTO etc. SMPS have the capacity to handle the variable loads. For the power supply designers the efficiency, weight and size of power supplies are a great area of concern. In this paper the SMPS circuit having power MOSFET for switching operation and by using pi controller based PWM for providing the feedback to the MOSFET for controlling purpose, is simulated in MATLAB. The output of SMPS remains constant irrespective of load and input voltage variation from 140v to 300v. The function of the converter is to provide a reliable and regulated output voltage at varying input voltage.

I. INTRODUCTION

In power electronics various process are used to convert the electrical energy from one form to another in an efficient, compact, clean and robust manner for convenient utilization. The aim of the project is to design and simulate the SMPS (switch mode power supply) circuit by the use of MATLAB for ac voltage to dc voltage conversion, having power MOSFET as a switch and feedback circuit to drive the power switch. This paper explains the operation of PWM control, SMPS (switching mode power supply), rectifier and buck converter. The block diagram shows the operation of the SMPS. This contains the two major circuits, one is power circuit and another one is control circuit which is used to control the power circuit by controlling the pulse which is provided for the power switch.

For some of the DC/DC and AC/DC application such as set top box, laptop adapters and telecom application, instead of low voltage rating power MOSFETs we use high voltage power MOSFETs because it possess high gate charge.

II. BUCK CONVERTER

This converter circuit is use to step down the voltage level from input according to the requirement

The operation is start with a switch that is open, it means no current is flow in the circuit when the switch is closed the current start flowing in the circuit.

Continuous conduction mode: In this mode current through the inductor never falls to zero during the commutation cycle

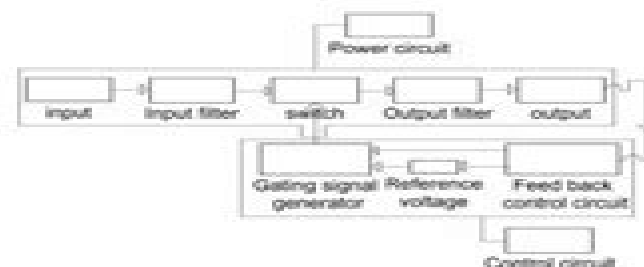


Figure 1: Block Diagram of SMPS

The operating principle is described by the Figures:



Figure 2: On-state mode



Figure 3: Off-state mode

The two circuit configurations of a buck converter are:

- On-state (when the switch is closed)
- Off-state (when the switch is open)

When the switch is in on state, the voltage across the inductor is $V_L = V_i - V_o$. The whole current flow through the inductor and the diode is reverse-biased. This inductor current rise linearly. When the switch is in off state, the diode act as forward biased. Now the voltage across the inductor is $= -V_o$ and the Current I_L decreases. The energy stored in the inductor L is $E = \frac{LI^2}{2}$

Design Of Switched Mode Power Supply Using Matlab Simulink

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International Conference on Computer Applications 2012 :: Volume 03 Kokula Krishna Hari K, **Design and Power Quality Improvement of Photovoltaic Power System** Adel A. Elbaset,M. S. Hassan,2016-11-24 This book presents a case study on a new approach for the optimum design of rooftop grid connected photovoltaic system installation The study includes two scenarios using different brands of commercially available PV modules and inverters It investigates and compares several different rooftop grid connected PV system configurations taking into account PV modules and inverter specifications The book also discusses the detailed dynamic MATLAB Simulink model of the proposed rooftop grid connected PV system and uses this model to estimate the energy production capabilities cost of energy COE simple payback time SPBT and greenhouse gas GHG emissions for each configuration The book then presents a comprehensive small signal MATLAB Simulink model for the DC DC converter operated under continuous conduction mode CCM First the buck converter is modeled using state space average model and dynamic equations depicting the converter are derived Then a detailed MATLAB Simulink model utilizing SimElectronics Toolbox is developed Lastly the robustness of the converter model is verified against input voltage variations and step load changes *International Conference on Advances in Power Generation from Renewable Energy Sources (APGRES-2020)* Editor in Chief Dr. D. Dhalin Editor Dr. Veeresh Fuskele Dr. Shiv Lal Dr. B. L. Gupta,2020-03-04 International Conference on Advances in Power Generation from Renewable Energy Sources APGRES 2020 *Emerging Technologies & Applications in Electrical Engineering* Anamika Yadav,K Chandrasekaran,V Hari Priya,D Suresh,2024-07-08 The First International Conference on Emerging Technologies and Applications in Electrical Engineering ETAEE 2023 was hosted and organized by the Department of Electrical Engineering National Institute of Technology Raipur held on 21st to 22nd December 2023 with CRC Press Taylor and Francis as publication partner ETAEE 2023 aims to emerge as a platform for in depth discussions knowledge sharing and collaborative efforts The main theme of the conference was Sustainable Energy Future With professionals from academia industry and reputable research institutions coming together the conference underlined the importance of staying at the forefront of technical breakthroughs to ensure a sustainable energy future The presentations were delivered by participants on various topics such as Renewable Energy Smart Grid High Voltage Technologies Power Electronics and Drives Electric Transportation Systems Instrumentation Control and IoT Applications in Electrical Engineering Esteemed academicians chaired these sessions fostering in depth discussions and knowledge exchange Proceedings of the International Conference on Information Engineering, Management and Security 2015 Vignesh Ramakrishnan,Prasanth Venugopal,Tuhin Mukherjee,2015-08-13 ICIEMS 2015 is the conference aim is to provide a platform for researchers engineers academicians as well as industrial professionals from all over the world to present their research results and development activities in Engineering Technology Industrial Engineering Application Level Security and Management Science This conference

provides opportunities for the delegates to exchange new ideas and application experiences face to face to establish business or research relations and to find global partners for future collaboration **MATLAB for Engineers** Karel

Perutka,2011-10-13 The book presents several approaches in the key areas of practice for which the MATLAB software package was used Topics covered include applications for Motors Power systems Robots Vehicles The rapid development of technology impacts all areas Authors of the book chapters who are experts in their field present interesting solutions of their work The book will familiarize the readers with the solutions and enable the readers to enlarge them by their own research It will be of great interest to control and electrical engineers and students in the fields of research the book covers **Power**

Electronic Converters Narayanaswamy P R Iyer,2018-03-09 Provides a step by step method for the development of a virtual interactive power electronics laboratory The book is suitable for undergraduates and graduates for their laboratory course and projects in power electronics It is equally suitable for professional engineers in the power electronics industry The reader will learn to develop interactive virtual power electronics laboratory and perform simulations of their own as well as any given power electronic converter design using SIMULINK with advanced system model and circuit component level model Features Examples and Case Studies included throughout Introductory simulation of power electronic converters is performed using either PSIM or MICROCAP Software Covers interactive system model developed for three phase Diode Clamped Three Level Inverter Flying Capacitor Three Level Inverter Five Level Cascaded H Bridge Inverter Multicarrier Sine Phase Shift PWM and Multicarrier Sine Level Shift PWM System models of power electronic converters are verified for performance using interactive circuit component level models developed using Simscape Electrical Power Systems and Specialized Technology block set Presents software in the loop or Processor in the loop simulation with a power electronic converter examples **Proceedings of the 1st International Conference on Electronic Engineering and Renewable**

Energy Bekkay Hajji,Giuseppe Marco Tina,Kamal Ghoumid,Abdelhamid Rabhi,Adel Mellit,2018-08-01 The proceedings present a selection of refereed papers presented at the 1st International Conference on Electronic Engineering and Renewable Energy ICEERE 2018 held during 15 17 April 2018 Saidi Morocco The contributions from electrical engineers and experts highlight key issues and developments essential to the multifaceted field of electrical engineering systems and seek to address multidisciplinary challenges in Information and Communication Technologies The book has a special focus on energy challenges for developing the Euro Mediterranean regions through new renewable energy technologies in the agricultural and rural areas The book is intended for academia including graduate students experienced researchers and industrial practitioners working in the fields of Electronic Engineering and Renewable Energy *Bulletin of Electrical Engineering and Informatics* Tole Sutikno,Auzani Jidin,Mochammad Facta,2014-03-01 Table of Contents Using HBMO Algorithm to Optimal Sizing Sitting of Distributed Generation in Power System Noradin Ghadimi 1 8 Management of Urban Parking Lot Energy Efficiency with the Application of Wind Turbine and LED lights Bekir Z Yuksek Ulan Dakeev 9 14 Indirect

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Proceedings of the 4th International Conference on Electronic Engineering and Renewable Energy Systems—Volume 1 Bekkay Hajji, Antonio Gagliano, Adel

Mellit, Abdelhamid Rabhi, Michele Cali, 2025-03-19 This book includes papers presented at the 4th International Conference on Electronic Engineering and Renewable Energy ICEERE 2024 held in Saidia Morocco which focus on the application of artificial intelligence techniques emerging technology and the Internet of things in electrical and renewable energy systems including hybrid systems micro grids networking smart health applications smart grid mechatronics and electric vehicles It particularly focuses on new renewable energy technologies for agricultural and rural areas to promote the development of the Euro Mediterranean region Given its scope the book is of interest to graduate students researchers and practicing engineers working in the fields of electronic engineering and renewable energy The book represents Volume 1 for this conference proceedings which consist of a 2 volume book series

Power Converters with Digital Filter Feedback Control Keng C. Wu, 2016-01-22 Power Converter with Digital Filter Feedback Control presents a logical sequence that leads to the identification extraction formulation conversion and implementation for the control function needed in electrical power equipment systems This book builds a bridge for moving a power converter with conventional analog feedback to one with modern digital filter control and enlists the state space averaging technique to identify the core control function in analytical close form in s domain Laplace It is a useful reference for all professionals and electrical engineers engaged in electrical power equipment systems design integration and management Offers logical sequences to identification extraction formulation conversion and implementation for the control function needed Contains step by step instructions on how to take existing analog designed power processors and move them to the digital realm Presents ways to extract gain functions for many power converters power processing stages and their supporting circuitry

Proceedings of the 4th International Conference on Electrical and Information Technologies for Rail Transportation (EITRT) 2019 Limin Jia, Yong Qin, Baoming Liu, Zhigang Liu, Lijun Diao, Min An, 2020-04-07 This book reflects the latest research trends methods and experimental results in the field of electrical and information technologies for rail transportation which covers abundant state of the art research theories and ideas As a vital field of research that is highly relevant to current developments in a number of technological domains the subjects it covered include intelligent computing information processing Communication Technology Automatic Control etc The objective of the proceedings is to provide a major interdisciplinary forum for researchers engineers academicians as well as industrial professionals to present the most innovative research and development in the field of rail

transportation electrical and information technologies Engineers and researchers in academia industry and the government will also explore an insight view of the solutions that combine ideas from multiple disciplines in this field The volumes serve as an excellent reference work for researchers and graduate students working on rail transportation electrical and information technologies

Manufacturing Science and Technology, ICMST2011 Wu Fan,2011-11-22 Selected peer reviewed papers from the 2011 International Conference on Manufacturing Science and Technology ICMST 2011 September 16 18 2011 Singapore

Power Electronic Converters Modeling and Control Seddik Bacha,Iulian Munteanu,Antoneta Iuliana Bratcu,2013-11-12 Modern power electronic converters are involved in a very broad spectrum of applications switched mode power supplies electrical machine motion control active power filters distributed power generation flexible AC transmission systems renewable energy conversion systems and vehicular technology among them Power Electronics Converters Modeling and Control teaches the reader how to analyze and model the behavior of converters and so to improve their design and control Dealing with a set of confirmed algorithms specifically developed for use with power converters this text is in two parts models and control methods The first is a detailed exposition of the most usual power converter models switched and averaged models small large signal models and time frequency models The second focuses on three groups of control methods linear control approaches normally associated with power converters resonant controllers because of their significance in grid connected applications and nonlinear control methods including feedback linearization stabilizing passivity based and variable structure control Extensive case study illustration and end of chapter exercises reinforce the study material Power Electronics Converters Modeling and Control addresses the needs of graduate students interested in power electronics providing a balanced understanding of theoretical ideas coupled with pragmatic tools based on control engineering practice in the field Academics teaching power electronics will find this an attractive course text and the practical points make the book useful for self tuition by engineers and other practitioners wishing to bring their knowledge up to date

Role of Plug-in Electric Vehicles in Grid Management Services Ark Dev,Vineet Kumar,Vivek Prakash,2025-11-05 The increasing integration of plug in electric vehicles PEVs into power grids has sparked new challenges and opportunities in energy management grid stability and sustainable power solutions Role of Plug in Electric Vehicles in Grid Management Services provides a comprehensive exploration of how PEVs are transforming modern power networks offering solutions for demand side management vehicle to grid V2G integration and energy storage This book presents in depth discussions on emerging technologies smart charging strategies and optimization methods to ensure a resilient and efficient grid infrastructure With contributions from leading researchers and industry experts this book delves into critical areas such as the impact of EV integration on grid stability smart charging infrastructure battery health monitoring using AI and advanced power electronic converters for seamless EV grid interactions Covering both theoretical foundations and practical applications this book serves as an essential resource for researchers policymakers and professionals working at

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15th International Conference on Applications of Fuzzy Systems, Soft Computing and Artificial Intelligence Tools – ICAFS-2022 R. A. Aliev, J. Kacprzyk, W. Pedrycz, Mo. Jamshidi, M. B. Babanli, F. Sadikoglu, 2023-02-28

The general scope of the book covers diverse areas of fuzzy systems soft computing AI tools such as uncertain computation decision making under imperfect information deep learning and others The topics of the papers include theory and application of Soft Computing Neuro Fuzzy Technology Intelligent Control Deep Learning Machine Learning Fuzzy Logic in Data Analytics Evolutionary Computing Fuzzy logic and Artificial Intelligence in Engineering Social Sciences Business Economics Material Sciences and others This book presents the proceedings of the 16th International Conference on Applications of Fuzzy Systems Soft Computing and Artificial Intelligence Tools ICAFS 2022 held in Budva Montenegro on August 26 27 2022 This is a useful guide for academics practitioners and graduates in fields of fuzzy logic and soft computing It allows for increasing of interest in development and applying of these paradigms in various real life fields

Power-Switching Converters, Second Edition Simon Ang, Alejandro Oliva, 2005-03-17

After nearly a decade of success owing to its thorough coverage abundance of problems and examples and practical use of simulation and design *Power Switching Converters* enters its second edition with new and updated material entirely new design case studies and expanded figures equations and homework problems This textbook is ideal for senior undergraduate or graduate courses in power electronic converters requiring only systems analysis and basic electronics courses The only text of such detail to also include the use of PSpice and step by step designs and simulations *Power Switching Converters Second Edition* covers basic topologies basic control techniques and closed loop control and stability It also includes two new chapters on interleaved converters and switched capacitor converters and the authors have added discrete time modeling to the dynamic analysis of switching converters The final two chapters are dedicated to simulation and complete design examples respectively PSpice examples and MATLAB scripts are available for download from the CRC Web site These are useful for the simulation of students designs Class slides are also available on the Internet Instructors will appreciate the breadth and depth of the material more than enough to adapt into a customized syllabus Students will similarly benefit from the more than 440 figures and over 1000 equations ample homework problems and case

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