



# Bldc Motor Drive

**Chang-liang Xia**



## **Bldc Motor Drive:**

**Permanent Magnet Brushless DC Motor Drives and Controls** Chang-liang Xia, 2012-04-24 An advanced introduction to the simulation and hardware implementation of BLDC motor drives A thorough reference on the simulation and hardware implementation of BLDC motor drives this book covers recent advances in the control of BLDC motor drives including intelligent control sensorless control torque ripple reduction and hardware implementation With the guidance of the expert author team readers will understand the principle modelling design and control of BLDC motor drives The advanced control methods and new achievements of BLDC motor drives of interest to more advanced readers are also presented Focuses on the control of PM brushless DC motors giving readers the foundations to the topic that they can build on through more advanced reading Systematically guides readers through the subject introducing basic operational principles before moving on to advanced control algorithms and implementations Covers special issues such as sensorless control intelligent control torque ripple reduction and hardware implementation which also have applications to other types of motors Includes presentation files with lecture notes and Matlab 7 coding on a companion website for the book *BLDC Motor Drive Simulation and Control* Dr. Devendra Potnuru, Electric motors is necessary for all most of all practical systems and becoming integral part in everybody life of modern living It is hard to imagine that there are more than 700million electric motor drive systems of various sizes are operational throughout the world In the last few years conditions have been changed in adjustable speed drives due to wide spread use of power semiconductor devices with available ratings up to 6000V and 3000A without even connecting series or paralleling the devices The present competitive development in the solid state devices control systems and signal processing all over the world result in significant progress in performance of AC drives and decreasing the overall drive cost In order to meet different practical applications various types of motors such as synchronous motors induction motors DC motors switched reluctance motors from several milliwatts to millions of kilowatts The Permanent Magnet Brushless DC BLDC motors have been emerged in wide areas of real world applications due to their higher power density good dynamic performance and ease of control Further the motor has high efficiency over a good speed range In this book simulation of BLDC motor drive and its control is elaborately discussed and is useful for students and faculty members to understand the simulation and control aspect of BLDC motor drive *Optimized Speed Control Strategies of BLDC Motor Drive* Upama Das, Sukanta Debnath, Pabitra Kumar Biswas, 2024-03-11 This book presents a broad explanation on the effect of performance of an open loop and closed loop control of a Brushless Direct Current BLDC Motor drive supplied from a two level voltage source inverter VSI working on 120 degree mode of conduction simulated in MATLAB based software for both No load and load condition BLDC motors are superior to other motors because of the high reliability good efficiency high power concentration simplicity of control and mainly the brushless operation It is found that by tuning the value of rotor position the variation in torque can be minimized Different performance parameters for no load and load

condition of the BLDC motor like phase voltages and currents speed electromagnetic torque direct axis quadrature axis current and rotor position etc are determined in MATLAB environment This book focuses on exploring and estimating the efficiency of a continuous brushless DC motor PMSM drive controlled by a current controller with various combinations of Classical Controllers as Proportional Integral Genetic Algorithm based PI Proportional Integral Derivative Controller Typical PWM operated control strategy is applied in the conventional two level voltage source inverter VSI fed permanent magnet BLDC motor to minimize the torque ripple As the inner current loop should be ahead in procedure associated with the external speed loop thus PI controllers are mostly chosen as a current controller These controller gains are enhanced by means of two optimization methods of Particle swarm optimization and Genetic algorithm to get a better response by eliminating steady state error maximum peak overshoot and decreasing the rising time peak time of the projected Brushless Direct Control motor drive

**Electric Motor Control** Sang-Hoon Kim, 2017-05-09 Electric Motor Control DC AC and BLDC Motors introduces practical drive techniques of electric motors to enable stable and efficient control of many application systems also covering basic principles of high performance motor control techniques driving methods control theories and power converters Electric motor drive systems play a critical role in home appliances motor vehicles robotics aerospace and transportation heating ventilating and cooling equipment s robotics industrial machinery and other commercial applications The book provides engineers with drive techniques that will help them develop motor drive system for their applications Includes practical solutions and control techniques for industrial motor drive applications currently in use Contains MATLAB Simulink simulation files Enables engineers to understand the applications and advantages of electric motor drive systems

**Permanent Magnet Synchronous and Brushless DC Motor Drives** Ramu Krishnan, 2017-12-19 Despite two decades of massive strides in research and development on control strategies and their subsequent implementation most books on permanent magnet motor drives still focus primarily on motor design providing only elementary coverage of control and converters Addressing that gap with information that has largely been disseminated only in journals and at conferences Permanent Magnet Synchronous and Brushless DC Motor Drives is a long awaited comprehensive overview of power electronic converters for permanent magnet synchronous machines and control strategies for variable speed operation It introduces machines power devices inverters and control and addresses modeling implementation control strategies and flux weakening operations as well as parameter sensitivity and rotor position sensorless control Suitable for both industrial and academic audiences this book also covers the simulation low cost inverter topologies and commutation torque ripple of PM brushless DC motor drives Simulation of the motor drives system is illustrated with MATLAB codes in the text This book is divided into three parts fundamentals of PM synchronous and brushless dc machines power devices inverters PM synchronous motor drives and brushless dc motor drives With regard to the power electronics associated with these drive systems the author Explores use of the standard three phase bridge inverter for driving the machine power factor correction

and inverter control Introduces space vector modulation step by step and contrasts with PWM Details dead time effects in the inverter and its compensation Discusses new power converter topologies being considered for low cost drive systems in PM brushless DC motor drives This reference is dedicated exclusively to PM ac machines with a timely emphasis on control and standard and low cost converter topologies Widely used for teaching at the doctoral level and for industrial audiences both in the U S and abroad it will be a welcome addition to any engineer s library *A Brushless DC Motor Drive Without a DC Link Capacitor* Samitha Ransara Hewa Kokawalage,2015 In recent years economic and environmental considerations have led the industry towards energy efficient technologies As a result in the context of industrial motor drives Brushless DC BLDC and Permanent Magnet Synchronous PMS motors have become popular as energy efficient and reliable alternatives for induction motors Both BLDC and permanent magnet synchronous motors are electronically commutated based on the position of the rotor by using voltage source inverters that consist of a rectifier a DC link capacitor and an inverter In comparison to the other electronic components in the circuit the DC link capacitor has a limited lifetime which is severely dependent on the ambient operating temperature However with advancements in technology direct power converters such as matrix converters that do not employ DC link capacitors are becoming popular in industry At present matrix converters and similar style direct converters are economically feasible in high power applications and are expected to be economically feasible for low power ratings in the future A technique to eliminate the DC link capacitor from conventional BLDC motor drives is proposed in this thesis Without the DC link capacitor the BLDC motor directly operates from the rectified mains supply A single switch control technique that allows speed and torque control of the BLDC motor is adopted The proposed technique is simulated and experimentally validated Also a comprehensive performance comparison is carried out between the proposed technique and the conventional techniques Although the proposed technique produces periodic torque ripples the effectiveness of the proposed technique is validated for low cost BLDC motor drives A new comprehensive buck converter based mathematical model for the BLDC motor drive is presented to analyse the torque ripple Using the model uncontrollable torque regions that occur due to the variable input voltage of the DC link capacitor free BLDC motor drive are identified The reduction in torque due to the absence of the DC link capacitor is obtained by iteratively solving the mathematical model The proposed buck converter based model is verified by comparing the analytical results simulated results and the experimental results To compensate for the torque ripple a compensation technique based on an actively controlled small DC link capacitor is proposed A further simplified buck converter based model for the DC link capacitor free BLDC motor drive is proposed for practical purposes The simplified model is compared with the comprehensive buck converter based model to show the accuracy of the model Although the proposed compensation technique increases the hardware complexity of the motor drive the overall cost is expected to be lower A price comparison between the conventional BLDC motor drive and a DC link capacitor free BLDC motor drive with the proposed compensation technique is presented

using volumetric pricings obtained through retailers The effectiveness of the proposed compensation technique is verified by simulations and experimental results As a solution for complex controls associated with matrix converters a simple switching algorithm that facilitates the driving of a BLDC motor by a 1 3 matrix converter is presented Safe commutation techniques are described in detail and the proposed technique is verified by using simulation and experimental results In principle the techniques proposed in this thesis are expected to be useful in manufacturing low cost BLDC motor drives with comparable performance

**Motor Drive Technologies for the Power-by-wire (PBW) Program: Options, Trends and Tradeoffs**,1995 Intelligent Control of Brushless DC Motors for Hybrid Electric Vehicle Applications Aayush Gupta,2010 Study and Test of a BLDC Motor Drive Systems Function and Operation for a Pump Application ,2004 *Brushless Dc Motors*

Thomas J. Sokira,Wolfgang Jaffe,1990 **A Brushless Direct Current Motor Drive Without Rotor Position Sensors** Michael Paul Copeland,1997 **Test Platform for Advanced Digital Control of Brushless DC Motors (MSFC Center Director's Discretionary Fund)** ,2002 Automatic Control and Mechatronic Engineering III Abdel-Hamid I.

Mourad,2014-08-11 Selected peer reviewed papers from the 3rd International Conference on Automatic Control and Mechatronic Engineering ICACME 2014 June 13 14 2014 Xiamen China Modern Power Electronics Bimal K. Bose,1992 Provides the latest techniques and energy saving applications for working with power semiconductor devices ac dc converters ac ac converters dc dc converters dc ac converters PWM methods and converter applications This book starts with a very comprehensive tutorial section which reviews state of the art power electronics technology integrating power semiconductor devices different classes of converter topologies PWM techniques and key power electronics applications

Instruments, Measurement, Electronics and Information Engineering J.Z. Ma,2013-08-08 Selected peer reviewed papers from the 2013 International Conference on Precision Mechanical Instruments and Measurement Technology ICPMIMT 2013 May 25 26 2013 Shenyang Liaoning China **Manufacturing Technology, Electronics, Computer and Information**

**Technology Applications** Zhang Lin,Hong Ying Hu,Ya Jun Zhang,Jian Guo Qiao,Jia Min Xu,2014-11-27 Selected peer reviewed papers from the 2014 International Conference on Manufacturing Technology and Electronics Applications ICMTEA 2014 November 8 9 2014 Taiyuan Shanxi China **The Design of Motor Drive for Brushless DC Motor** Tze-Yee Ho,2018

The electric machines have been applied to the industrial and commercial areas for several decades The high performance of control and fast dynamic response of electric machines can be achieved via motor drive because of high development of semiconductors such as the microcontroller and power transistors Brushless DC motor BLDC and permanent magnet AC synchronous motors drives have many advantages such as high efficiency small size less rotor losses and fast torque response over the induction motor drives Therefore this chapter will focus on the design and implementation of a motor drive as well as its realization of control algorithm At the beginning of chapter the fundamental of energy conversion for electric machines is introduced The dynamic model for brushless dc motor is derived and explained in detail in section two The 120

conduction and 180 conduction of switching device for an inverter are also described and illustrated The control design of a speed controlled motor drive is described in section three The hardware and software design of a motor drive based on a microcontroller is given in section four The experimental results are also presented and discussed Finally a conclusion is made in section five

**Hybrid Electric Vehicle Technology** Society of Automotive Engineers,2004 Proceedings of the ... IEEE/ASME Joint Rail Conference ,2003

**Semiconductors** Werner Klingenstein,2004-05-31 Providing a comprehensive insight into today s standard technologies this book covers the vast range of semiconductor products and their possible applications The material ranges from the basics of conventional semiconductor technology through standard power and opto semiconductors to highly complex memories and microcontrollers and the special devices and modules for smartcards automotive electronics consumer electronics and telecommunications Several chapters are devoted to the production of semiconductor components and their use in electronic systems as well as to quality management The book offers both students and users a unique overview of technology architecture and areas of application of semiconductor products The enclosed CD ROM includes data on a multitude of products

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