

Three-phase Inverter Using Microcontroller for Speed Control Application on Induction motor

Faizal Arya Samman, Tajuddin Waris, Tiara Dwi Anugerah, Muhammad Nurulim Zain Mide
Electrical Department, Engineering Faculty, Hasanaddin University

faizal@unhas.ac.id, tajuddin@unhas.ac.id, tiara@comcast.net, muhammadnurulimzainmide@gmail.com

Abstract - This paper presents a PWM-controlled three-phase inverter designed for controlling the speed of a three phase induction motor. Inverter has very important role as a power conditioning on the electric power system and industrial field. The speed of the induction motor can be controlled by changing the voltage frequency input of the induction motor. The three phase inverter is implemented by using a Power MOSFET and the PWM signal is generated by a Microcontroller. The inverter performance is measured by simulation and experimental test. Inverter circuit is simulated using PSpice software to investigate the inverter behavior and performance. The testing is conducted using two induction motors with different rpm specification. The testing result shows that the Microcontroller can control well the motor speed in no-load mode with various speed references.

I. INTRODUCTION

Induction motor is the most widely electrical machine used in industry, due to its simple construction, sturdy, cheap, and easy maintenance. The induction motor have shifted the use of DC motor in the industry. However, induction motor has several parameters that are non-linear, especially the rotor resistance which varies for different operating conditions. It causes speed control on induction motor is more difficult in comparison with speed control on DC machine.

Common application of induction machine is for constant speed rotation by direct connection to the grid, rotor speed is determined by the grid system frequency. For variable speed application of induction motor, power conditioning device is required [1].

Speed control of an induction machine can be made by any change of pole number or input voltage frequency of induction motor. However, changing of its pole number is unfractical. Changing of input voltage frequency is realized by using a power conditioning or inverter. The use of inveter is a simple and easy way for controlling speed of induction motor and it has been broadly used on industry application [2],[3].

Inverter converts DC voltage into AC voltage where magnitude and frequency voltage can be varied as required. AC voltage generated is a square waveform or trapesoid. The application of filter device is required to produce pure sinusoidal waveform.

Voltage output regulation of inverter can be done in two ways. First, by adjusting the DC input voltage but the switching frequency is constant. Second, by adjusting the switching frequency while the DC input voltage is constant. In the second methode, the effective AC voltage generated is a function of the pulse width of the switching. How is called Pulse Width Modulation (PWM). [3]

II. THREE-PHASE INVERTER CIRCUIT

The basic circuit of three-phase inverter is presented in Figure 1. It has two capacitors to generate N points for each capacitor voltage $V_i / 2$ remains constant. There are three sides of the switch, namely: switch S1 and S1 + S2 + and S2- as well. Both sides of the switch, the switch S1 and S4, S3 and S4, and S5 and S2. Each switch, S1 and S4, or S3 and S4, or S5 and S2, can not operate simultaneously, because there will be short circuit. ON and OFF from both sides of the switch is determined by the PWM modulation technique [4],[5].

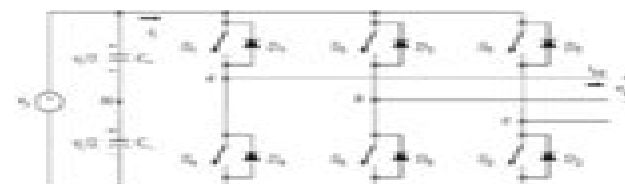


Figure 1. Three fasa Inverter Circuit

To produce the output voltage (V_o) in three phases, eight switching conditions configuration as shown in Table 1 should be applied.

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Microelectronics, Electromagnetics and Telecommunications Ganapati Panda, Suresh Chandra Satapathy, Birendra Biswal, Ramesh Bansal, 2018-11-02 The book discusses the latest developments and outlines future trends in the fields of microelectronics, electromagnetics, and telecommunication. It contains original research works presented at the International Conference on Microelectronics, Electromagnetics and Telecommunication ICMEET 2018 organised by GVP College of Engineering, Andhra Pradesh, India. The respective papers were written by scientists, research scholars, and practitioners from leading universities, engineering colleges, and R & D institutes from all over the world and share the latest breakthroughs and promising solutions to the most important issues facing today's society. PWM Control of a Three Phase Inverter Using a Microcontroller Mohd Zaidi Sofian, 1998 Smart Grids for Smart Cities, Volume 1 O. V. Gnana Swathika, K. Karthikeyan, Sanjeevikumar Padmanaban, 2023-07-05 SMART GRIDS for SMART CITIES Written and edited by a team of experts in the field, this first volume in a two-volume set focuses on an interdisciplinary perspective on the financial, environmental, and other benefits of smart grid technologies and solutions for smart cities. What makes a regular electric grid a smart grid? It comes down to digital technologies that enable two-way communication between a utility and its customers, as opposed to the traditional electric grid where power flows in one direction. Based on statistics and available research, smart grids globally attract the largest investment venues in smart cities. Smart grids and city buildings that are connected in smart cities contribute to significant financial savings and improve the economy. The smart grid has many components, including controls, computers, automation, and new technologies and equipment working together. These technologies cooperate with the electrical grid to respond digitally to our quickly changing electric demand. The investment in smart grid technology also has certain challenges. The interconnected feature of smart grids is valuable, but it tremendously increases their susceptibility to threats. It is crucial to secure smart grids wherein many technologies are employed to increase real-time situational awareness and the ability to support renewables, as well as system automation to increase the reliability, efficiency, and safety of the electric grid. This exciting new volume covers all of these technologies, including the basic concepts and the problems and solutions involved with the practical applications in the real world. Whether for the veteran engineer or scientist, the student or a manager or other technician working in the field, this volume is a must-have for any library. **Information and Communication Technology for Competitive Strategies (ICTCS 2020)** Amit Joshi, Mufti Mahmud, Roshan G. Ragel, Nilesh Singh V. Thakur, 2021-07-26 This book contains the best selected research papers presented at ICTCS 2020 Fifth International Conference on Information and Communication Technology for Competitive Strategies. The conference was held at Jaipur, Rajasthan, India, during 11-12 December 2020. The book covers state-of-the-art as well as emerging topics pertaining to ICT and effective strategies for its implementation for engineering and managerial applications. This book contains papers mainly focused on ICT for computation, algorithms, and data analytics and IT security. *ICSEDIT 2022* Herve Boileau, Lu

Wen Feng, Lauric Garbuio, Hilfi Pardi, 2023-01-16 This book is the proceeding of the International Conference on Sustainable Engineering Development and Technological Innovation ICSEDTI 2022 that was successfully held on 11-13 October 2022 using a hybrid platform. The conference is themed Sustainable empowerment of innovative solutions through the development of integrated scientific researches to enhance the advanced technological world which represents our belief of how sustainability is essential in our approach to solve problems through technological innovation. A total of 56 papers were submitted and presented within the sessions of the conference. The papers' topics revolve around Informatics, Technology, Electrical Technology, Marine Technology, Manufacturing System and Technology, Mechanical Engineering, and also Information Industry and Management. In addition to the technical paper presentations, there were also five keynote speeches featured, and eight plenary talks were delivered. Two of the keynote speeches were delivered in person by Professor Selo from Universitas Gajah Mada Indonesia and Professor Goib Wiranto from the National Research and Innovation Agency Indonesia. The rest of the keynote speeches were delivered online by Professor Yvon Kermarrec from IMT Atlantique France, Professor Ian Gibson from University of Twente, Netherlands, and Dr. Ilham Akbar Habibie from The Association of Indonesian Engineer Indonesia. It was a great pleasure to work with the technical program committee led by Mr. Hilfi Pardi, who have completed the imperative process of peer review on the technical papers submitted in this conference. We are also very fortunate to have on our side the excellent organizing committee team of the Faculty of Engineering of UMRH who work very hard to organize and support the conference. Finally, our appreciation to all the authors who have participated in this conference with their amazing achievements and enthusiasm. We firmly believe that ICSEDTI is a suitable platform for researchers, engineers, and developers who are concerned with sustainability in engineering and technological development. We hope in the coming years ICSEDTI will be better in terms of the organization of the conference, the quantity, and the quality of the researches submitted, and most importantly, the impact on the sustainability of technological innovation.

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outer speed loop of coascade control In this project investigation of effect of anti windup C code on drive performance is done The flexible board has microcontroller current sensor and H bridge circuit on it which will be used to supply voltage to PMDC motor As a PMDC motor DC motor rig is used which has two identical DC motor coupled together and one motor have encoder fitted on it and other motor have tacho generator fitted on it

Computational Aspects of Electromechanical Energy Converters and Drives International Association for Mathematics and Computers in Simulation. International Conference, Réal-Paul Bouchard, Guy Olivier, Ecole polytechnique (Montréal, Québec). Département de génie électrique et de génie informatique, 1993 *Proceedings*, 1999 *Standard Handbook for Electrical Engineers* Donald Fink, H. Wayne Beaty, 2006-09-15 The Standard Handbook for Electrical Engineers has served the EE field for nearly a century Originally published in 1907 through 14 previous editions it has been a required resource for students and professionals This new 15th edition features new material focusing on power generation and power systems operation two longstanding strengths of the handbook that have recently become front burner technology issues At the same time the entire format of the handbook will be streamlined removing archaic sections and providing a quick easy look up experience

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