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Performance Improvement of AC Drives by High Power Converters

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Abstract: *High performance AC drives fed by power electronic converters are a key component of the high-tech sector's efforts to reduce energy consumption and increase productivity. The converter topologies, modulation methods, control and estimating approaches, as well as other important components of controlled induction motor drive systems, are reviewed in this study along with current state and tendencies in development. The enumerated topologies are described: Current source converters, direct converters, and two- and multi-level voltage source converters. Traditional bipolar and unipolar PWM, space vector modulation (SVM) with extension for multilevel converters, harmonic control techniques, and variable frequency modulation (hysteresis, nearest level, and model predictive algorithms) are a few of the modulation techniques that are briefly covered. Regarding the control techniques, the two categories of generic torque control methods—linear controllers and nonlinear controllers—are explained.When 4500-V gate turn-off (GTO) transistors became widely available on the market in the middle of the 1980s, the development of high-power converters and medium-voltage (MV) drives began. Up until the introduction of high-power insulated gate bipolar transistors (IGBTs) and gate-commutated thyristors (GCTs) in the late 1990s [2, 3], the GTO served as the industry standard for the MV drive. Due to their excellent switching properties, lower power losses, simplicity of gate control, and snubbers operation, these switching devices have quickly advanced into the key areas of high-power electronics*

Keywords: High Power Converter, Boost Converter, AC Drive, Power Electronics Circuits

I. INTRODUCTION

Installation of the MV drive may result in significant energy cost savings. According to reports, using the variable-speed MV drive reduced the investment's payback period from one to two and a half years. In some situations, the MV drive's utilization can also boost productivity. In one instance, an MV drive allowed a big fan at a cement facility to have its speed adjusted. Regular cleaning of the fixed-speed fan blades' accumulated dust necessitated a large amount of downtime for maintenance each year. The blades only needed to be cleaned during the production halt once a year with variable-speed operation. The investment paid for itself within six months due to the increase in productivity and energy savings.

The basic goal of power system operation and control is to keep all system consumers continuously supplied with acceptable-quality power. When the amount of electricity generated and needed is balanced, the system will be in equilibrium. The majority of all electrical energy generated is used to power electric motors, with motors ranging in size from under 1 W to several dozen MW being employed in the process. Various expectations are placed on modern drive systems, some of which include:

- Maximum conversion efficiency,
- Wide range steeples adjustment of angular speed, torque, acceleration, angular and linear position,
- Fast error elimination when the control and/or disturbance signals are being changed,
- Maximum utilization of motor power under reduced voltage, current, etc.,
- Reliable, user friendly operation

The theory of electric motors, control theory, and industrial electronics are all strongly incorporated into today's drive control engineering. However, the last of these fields is crucial to the creation of automated electrical drive systems.

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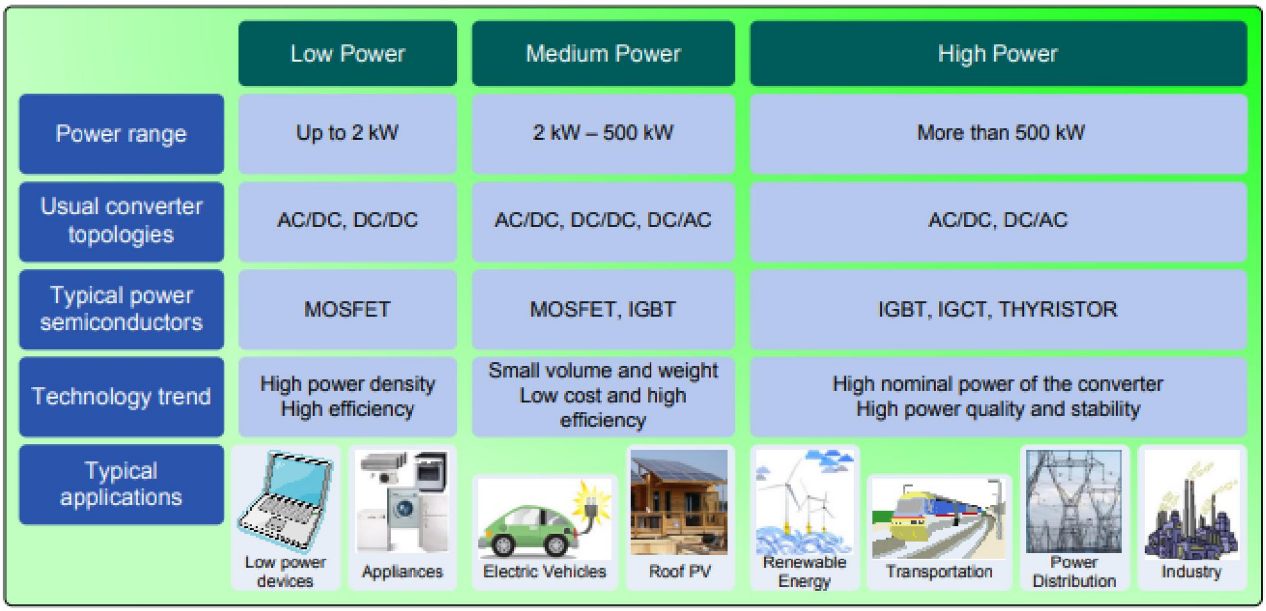
Digital signal processing and power electronics, the two fundamental subfields of industrial electronics, have paved the path for AC motors to take the role of DC brush motors in high performance drives.

New converter topologies have always been sparked by the introduction of new power semiconductor technologies. Beginning with diode and thyristor line commutated converters, it later progressed to forced commutated converters that are modern and controlled by pulse width modulation (PWM) techniques. It would take too long to mention every power electronics application. As a result, from low to high power group, the common applications of power electronic converters are categorized in Figure 1.

Power converter topologies, power converter modulation methods, control, and estimation are the three main sections of this paper's discussion of high performance AC drives supplied by power converters.



II. POWER CONVERTER TOPOLOGIES

2.1 Voltage Source Converter

Today, voltage source converters are regarded as a mature technology and are among the most widely used power converter topologies in business. In 2a, the fundamental 2-level voltage source inverter (2L-VSI) is displayed. A DC capacitor or voltage source, which gives it its name, and a configuration of two power semiconductors per phase make up the device. The load is connected to either the positive or the negative bar and there are only two potential output voltage levels because the gating signals for both power switches are complimentary. It is feasible to synthesize output voltages with the desired fundamental component by modulating the gating pulses to create them. These converters are typically used with very inductive loads like motors due to the high harmonic content in the output voltage that needs to be filtered to create nearly sinusoidal currents [2], but occasionally, depending on the application, an additional output filter may be needed.

2.2 Current Source Converters

The basic topology of a current source inverter (CSI) is illustrated in Figure 3. These converters always require a controlled rectifier to ensure a constant current flowing through the DC link; typically, a thyristor-based rectifier is selected. A split inductor is used in the DC-link to lower the common mode voltage in the load. The inverter is an arrangement of power semiconductors similar to the VSI, but composed by gate turn-off thyristor. This converter is fundamentally regenerative and can operate at medium voltage. As seen in Figure 3b, a back-to-back setup might be used when a high-quality input current is required. As a result of the PWM currents present at the input terminals of the rectifier in this instance, the input side also needs a second-order LC filter.

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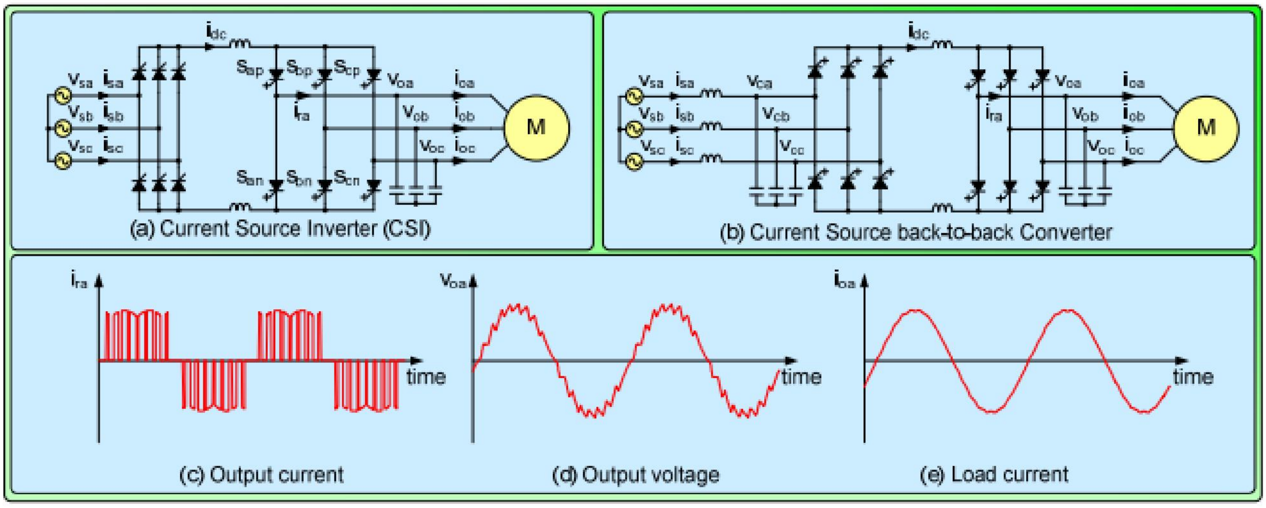


Figure 2. Topologies and output waveforms of the direct converters

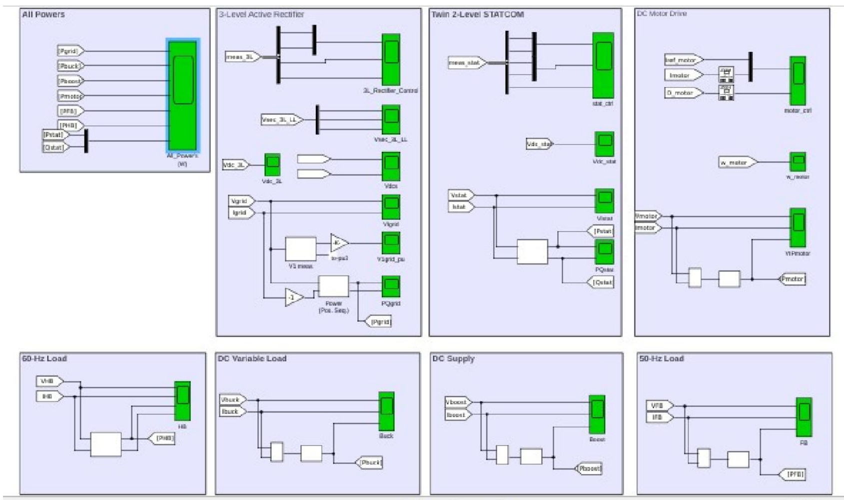
2.3 Direct Converters

This section presents a third group of converters that don't need energy storage components. The energy is transferred directly from the input side to the output side by the direct converter. The small reduction of these converters is their principal benefit, but the control system is complicated as a result. This category includes the cyclo converter, which is illustrated in Figure and is frequently employed in high-power applications like grinding mills. This converter is made up of a dual thyristor-based converter for each phase that may generate a variable DC voltage that is adjusted to match a sinusoidal waveform reference. Low-order harmonics of the input current are canceled out at the phase-shifted transformer feeding the input of each converter.

As seen in Figure, the fundamental component of the output voltage is a mixture of segments of the input voltages, each of which follows a sinusoidal reference. This converter is well suited to drive high-power low-frequency loads because of the way it works.

III. MATLAB SIMULATION & RESULTS

3.1 MODEL AND SIMULATION RESULTS FOR A RECTIFIER CIRCUIT& ALL POWER:



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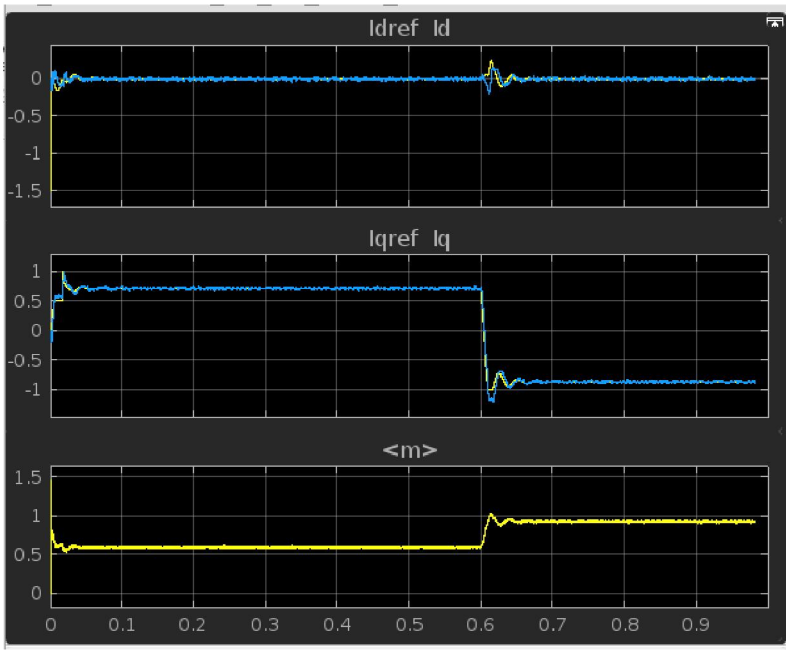

FIGURE 3: ACTIVE & REACTIVE POWER

3.2. MODEL AND SIMLATION RESULTS FOR HIGH POWER CONVERTER

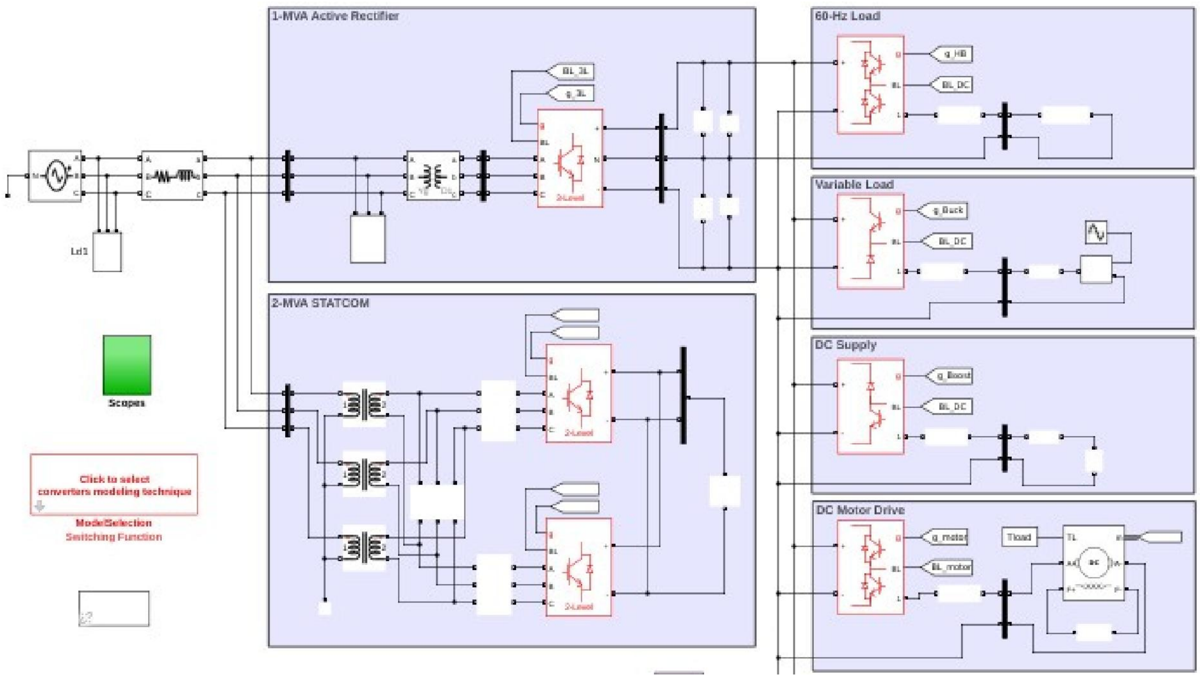

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FIGURE 4: ACTIVE & REACTIVE POWER

IV. CONCLUSION

High performance AC drives with power electronic control are a component of the high tech sector and are a key driver of productivity growth and energy efficiency. The converter topologies, pulse width modulation (PWM) approaches, as well as control and estimation methodologies, are some of the main components of controlled drive systems that this paper discusses. The ensuing topologies are explained: Current source converters, direct converters, and two- and multi-level voltage source converters. Traditional bipolar and unipolar PWM, Space Vector Modulation (SVM) with extension for multilevel converters, Harmonic control approaches, and Variable Frequency Modulation (hysteresis, nearest level, and model predictive technique) are among the PWM techniques that are briefly covered. The generic torque control techniques are then divided into two categories: linear controllers and nonlinear controllers. Field Oriented Control (FOC), Direct Torque Control (DTC) with Voltage SVM, and DTC with Flux Vector Modulation (DTC-FVM) are presented in the linear group. Classical Switching Table-based hysteresis DTC, Direct Self Control (DSC), and future trends solutions based on predictive DTC and neuro-fuzzy schemes are all included in the category of nonlinear control.

REFERENCES

[1] Alfith. (2017). TDR based-ATS Optimization (Automatic Transfer Switch) on Genset (Generator Set) 2800 Watt. National Seminar on role of science beyond future (pp. 226-232). Padang: Institute Technology of Padang.

[2] American National Standard Institute. (1966). Electrical and Electronics Diagrams. New York: The American Society of Mechanical Engineers

[3] BKI. (2019). Rules. Jakarta: Biro Klasifikasi Indonesia.

[4] Bunga, P. M. (2015). Design of long distance load control using Smart Relay. E-Journalof Electrical engeneering dan Komputer science, 4(5).

[5] Chen, K. W. (2004). The Electrical Engineering Handbook. Chicago:ElSevier Academic Press.

[6] Goh, H. H. (2017, October). Types of Circuit Breaker and its Applicationin Substation Protection. Indonesian Journal of Electrical Engineering and Computer Science. doi:10.1159/IJEECS vol. 8.i1. pp 213-220

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