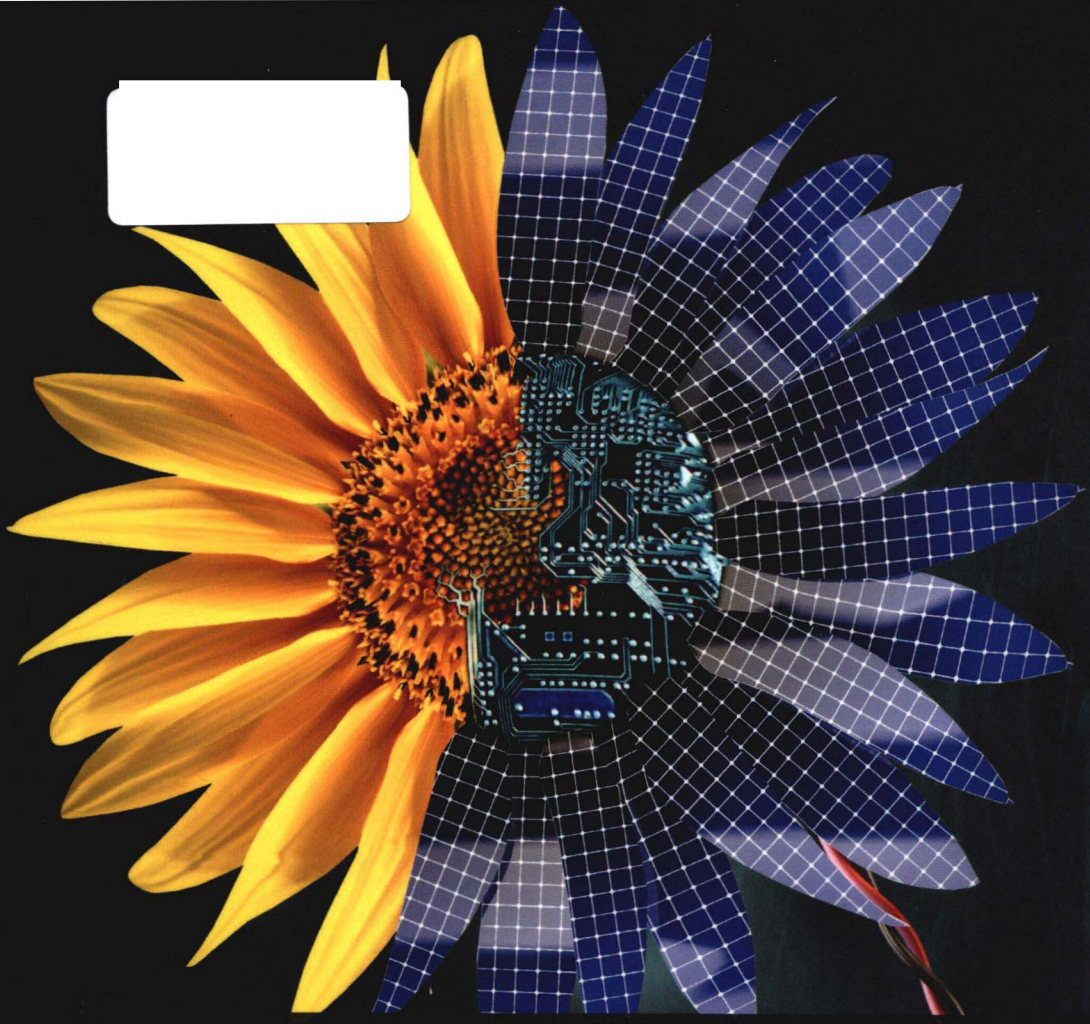

Alternative Energy in POWER ELECTRONICS

Muhammad H. Rashid

Alternative Energy in Power Electronics

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Preface

Electric power generated from renewable energy sources is getting increasing attention and supports for new initiatives and developments in order to meet the increased energy demands around the world. The availability of computer–based advanced control techniques along with the advancement in the high-power processing capabilities is opening new opportunity for the development, applications and management of energy and electric power. Power Electronics is integral part of the power processing and delivery from the energy sources to the utility supply and the electricity consumers.

The demand for energy, particularly in electrical forms, is ever-increasing in order to improve the standard of living. Power electronics helps with the efficient use of electricity, thereby reducing power consumption. Semiconductor devices are used as switches for power conversion or processing, as are solid state electronics for efficient control of the amount of power and energy flow. Higher efficiency and lower losses are sought for devices used in a range of applications, from microwave ovens to high-voltage dc transmission. New devices and power electronic systems are now evolving for even more effective control of power and energy.

Power electronics has already found an important place in modern technology and has revolutionized control of power and energy. As the voltage and current ratings and switching characteristics of power semiconductor devices keep improving, the range of applications continue to expand in areas, such as lamp controls, power supplies to motion control, factory automation, transportation, energy storage, multi-megawatt industrial drives, and electric power transmission and distribution. The greater efficiency and tighter control features of power electronics are becoming attractive for applications in motion control by replacing the earlier electromechanical and electronic systems. Applications in power transmission and renewable energy include high-voltage dc (VHDC) converter stations, flexible ac transmission system (FACTS), static var compensators, and energy storage. In power distribution, these include dc-to-ac conversion, dynamic filters, frequency conversion, and custom power system.

Audience:

The purpose of *Alternative Energy in Power Electronics* is a derivative of the best-selling *Power Electronics Handbook*, Third Edition. The purpose of *Alternative Energy in Power Electronics* is to provide a reference that is both concise and useful for engineering students and practicing professionals. It

is designed to cover topics that relate to renewable energy processing and delivery. It is designed as advanced textbooks and professional references. The contributors are leading authorities in their areas of expertise. All were chosen because of their intimate knowledge of their subjects, and their contributions make this a comprehensive state-of-the-art guide to the expanding filed energy of energy.

Muhammad H. Rashid, Editor-in-Chief

Any comments and suggestions regarding this book are welcome. They should be sent to

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Chapter 1

Power Electronics for Renewable Energy Sources

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Chapter Outline

Alternative Energy in Power Electronics

1.1 INTRODUCTION

The Kyoto agreement on global reduction of greenhouse gas emissions has prompted renewed interest in renewable energy systems worldwide. Many renewable energy technologies today are well developed, reliable, and cost competitive with the conventional fuel generators. The cost of renewable energy technologies is on a falling trend and is expected to fall further as demand and production increases. There are many renewable energy sources (RES) such as biomass, solar, wind, mini hydro and tidal power. However, solar and wind energy systems make use of advanced power electronics technologies and, therefore the focus in this chapter will be on solar photovoltaic and wind power.

One of the advantages offered by (RES) is their potential to provide sustainable electricity in areas not served by the conventional power grid. The growing market for renewable energy technologies has resulted in a rapid growth in the need of power electronics. Most of the renewable energy technologies produce DC power and hence power electronics and control equipment are required to convert the DC into AC power.

Inverters are used to convert DC to AC. There are two types of inverters: (a) stand-alone or (b) grid-connected. Both types have several similarities but