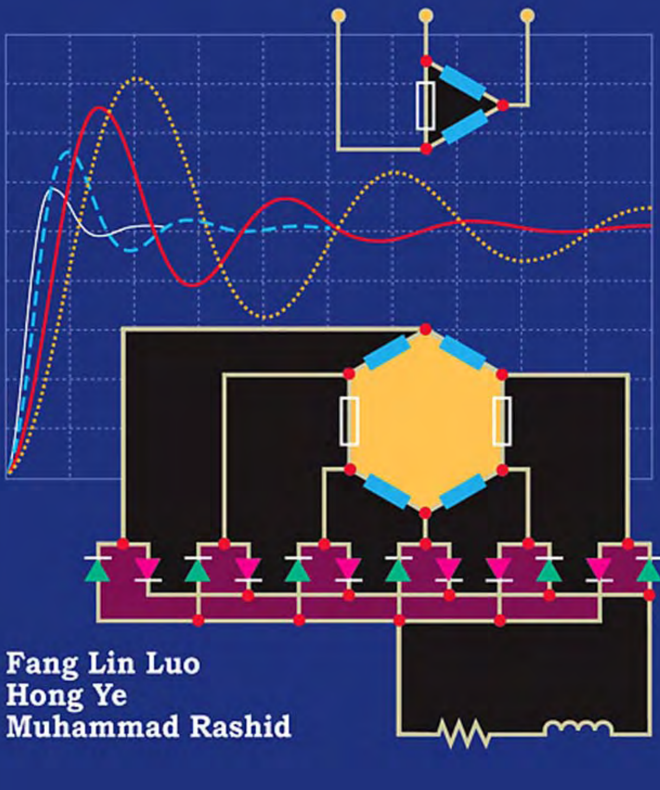
Digital Power Electronics *and* Applications



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Preface

The purpose of this book is to provide a theory of Digital Power Electronics and its applications. It is well organized in 400 pages and over 300 diagrams. Traditionally, Power Electronics is analyzed by the analog control theory. For over a century, people have enjoyed analog control in Power Electronics, and good results in the analog control and its applications in Power Electronics mislead people into an incorrect conclusion that Power Electronics **must** be in analog control scheme. The mature control results allowed people to think that Power Electronics is a sunset knowledge. We would like to change these incorrect conclusions, and confer new life onto the traditional Power Electronics. In this book the authors initially introduce the digital control theory applied to Power Electronics, which is completely different from the traditional control scheme.

Power Electronics supplies electrical energy from its source to its users. It is of vital importance to all of industry as well as the general public – just as the air that we breathe and water that we drink are taken for granted, until they are no longer available, so it is with Power Electronics. Therefore, we have to carefully investigate Power Electronics. Energy conversion technique is the main focus of Power Electronics. DC and AC motor drive systems convert the electrical energy to mechanical energy and vice versa. The corresponding equipment that drives DC and AC motors can be divided into four groups:

- AC/DC rectifiers;
- DC/AC inverters;
- DC/DC converters;
- AC/AC (AC/DC/AC) converters.

All of the above equipment are called power supplies. They are switching circuits working in a discrete state. High-frequency switch-on and switch-off semiconductor devices allow switching circuits to have the advantage of high power rate and efficiency, low cost, small size and high power density. The size of a flat-transformer working in 250 kHz is much less than 1% of the volume of a normal transformer working in 50 Hz with the same power rating. Switching circuits perform in switching-on and switching-off states periodically. The switching period, T, is the sampling interval ($T = 1/f$), where f is the switching frequency. Switching circuits, including all converters, transfer energy from a source to the end-users in discontinuous manner; i.e. the energy is not continuously flowing from a source to load. The energy is pumped by energy-quantization via certain energy-storage elements to load in a sampling interval.