Preface

The work presented in this book offers a general approach to the development of fixed switching frequency pulse width–modulated (PWM) strategies to suit hard-switched converters. It is shown that modulation of, and resulting spectrum for, the half-bridge single-phase inverter forms the basic building block from which the spectral content of modulated single-phase, three-phase, or multiphase, two-level, three-level, or multilevel, voltage link and current link converters can readily be discerned. The concept of harmonic distortion is used as the performance index to compare all commonly encountered modulation algorithms. In particular, total harmonic distortion (THD), weighted total harmonic distortion (WTHD), and harmonic distortion criterion specifically designed to access motor copper losses are used as performance indices.

The concept of minimum harmonic distortion, which forms the underlying basis of comparison of the work presented in this book, leads to the identification of the fundamentals of PWM as

- Active switch pulse width determination.
- Active switch pulse placement within a switching period.
- Active switch pulse sequence across switching periods.

The benefit of this generalized approach is that once the common threads of PWM are identified, the selection of a PWM strategy for any converter topology becomes immediately obvious, and the only choices remaining are to trade-off the “best possible” performance against cost and difficulty of implementation, and secondary considerations. Furthermore, the performance to be expected from a particular converter topology and modulation strategy can be quickly and easily identified without complex analysis, so that informed trade-offs can be made regarding the implementation of a PWM algorithm for any particular application. All theoretical developments have been confirmed either by simulation or experiment. Inverter implementation details have been included at the end of the text to address practical considerations.

Readers will probably note the absence of any closed loop issues in this text. While initially such material was intended to be included, it soon became apparent that the inclusion of this material would require an additional volume. A further book treating this subject is in preparation.