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Power Supply Design Book Should Benefit Seasoned Engineers As Well As Beginners

Switching Power Supply Design & Optimization, Second Edition, Sanjaya Maniktala, McGraw Hill Education, 2014, 551 pages, hardback, $125, ISBN 978-0-07-179814-3.

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This book is a second edition of Maniktala's *Switching Power Supply Design & Optimization*, which was originally published in 2004. It is also a follow-up to the author's S*witching Power Supplies: A to Z,* which was first published in 2006 and then appeared in its second edition in 2012. This second-edition of *Switching Power Supply Design & Optimization* is also carried by the IET in Britain and is larger in cross-sectional area and thinner, which if it were magnetic material would increase its inductance. It differs from S*witching Power Supplies: A to Z* in that it includes more on the TL431 IC, power-factor correction and input filtering, magnetics, soft switching, and resonant conversion.

This book covers engineering analysis and design methods for switching power supplies. It begins with a smattering of basic concepts about power-converter circuits such as regulator voltage references and voltage dividers as feedback circuits for regulation, then moves on to converter circuits and presents the basic engineering equations for the three PWM-switch configurations (buck, boost, and buck-boost) and their more common derivative topologies (forward, half-bridge, flyback, etc.) The author also includes many practical tips that are important for optimized design.

The style of writing in the book is informal, and the author attempts to be as explanatory as possible. Maniktala's chatty and somewhat verbose style can set the nervous newcomer to power circuits more at ease for a smooth ride by minimizing conceptual potholes along the road to better understanding. He includes some necessary math but tends to emphasize development of an intuition for converter behavior and especially the use of *practical heuristic design rules*. The emphasis is on how to design, though circuit analysis is included. This book is recommended for those new to power conversion who are designing power circuits and need help with circuit problems. It also has so much useful engineering content that it is also recommended as a reference book for experienced designers.

Maniktala is one of the few people who have discovered the importance of the ripple factor in converter optimization. This is the ratio of the amplitude of the varying component to the average component of a waveform. Although he does not emphasize its importance in magnetic design, he carries over from S*witching Power Supplies: A to Z* the role of ripple factor, which he calls *current ripple ratio*, in optimal converter circuit design. This insight, which has yet to permeate the industry, makes the book worth purchasing in itself.

The chapter on "Closing the Loop: Feedback and Stability" covers the control aspect and derives some of the most important incremental transfer functions for the power-converter switching blocks of the three basic configurations. This is more than some converter books have done, though the theory is not developed from rock bottom; the PWM switch model is not developed and its use in deriving the converter incremental equations is not given. While not badly done, this chapter also does not cover the more complicated mathematics of sampling system dynamics necessary to fully explicate the theory of the current loop. Yet it is the outer voltage control loop that rightfully receives most of the attention.

In keeping with the level of depth in the rest of the book, the control chapter is consistent in not overwhelming the reader with these somewhat esoteric (yet fundamental) aspects of control. Instead, the approach is to give the reader some heuristic guidance for control design. Christophe Basso's recently reviewed book on converter control would be a good complement to this book—and this book to Basso's last two books. And, I might add in advance, that both are good complements to my forthcoming book on power electronics optimization, which contains further simplifications, refinements and a more complete development of the theory from first principles. In the meantime, however, Maniktala's book(s) are among the leading aids for engineers who want to improve their design skills. This book definitely deserves a place within arm's reach on the practicing power engineer's bookshelf.

About The Author

Dennis Feucht has been involved in power electronics for 25 years, designing motor-drives and power converters. He has an instrument background from Tektronix, where he designed test and measurement equipment and did research in Tek Labs. He has lately been doing current-loop converter modeling and converter optimization.