

Preface

Electronics has undergone drastic changes and shifted towards massive digital signal processing in recent decades. However, even large digital-heavy systems are built around small analog cores, and analog signal processing is still the mainstay of the circuit design. Analog circuits have evolved from old discrete sampled-data circuits to new sophisticated digital-like time-domain switching circuits. In this evolution, numerical design methods relying on numerical analysis have been favored, and simulation tools were given undue credits for that.

Analog circuits and their fundamentals have been improved over the last century even without computer tools. Old analog designs were to improve circuits in relative terms using matching properties. On the contrary, new analog designs are to obtain absolute parameters such as low figure-of-merit, low power, and high speed. After 30 years of refinement, analog designers now come to believe that virtually all analog functions from DC to RF can be integrated at low voltages even with low power. Such euphoria of superior analog performance has been mostly fueled by aggressive device scaling down to the nanometer scale. It is true that simulation-based designs can handle circuits of large complexity, but in an effort to implement analog functions only with high-speed digital switching, the fundamentals of electronics have been often ignored.

More often than not, simulation-based designs end up with somewhat ambiguous and erroneous results ranging from violating the fundamental energy conservation law to obtaining instantaneous small-signal gain during brief large-signal transient period. They have veered off course with no obvious ends, which require necessary corrections. This book raises a concern about such analog design practices and commonly overlooked fallacies. While most recent literatures focus on answering mostly what and how, this book elaborates more on why and how.

Since analog design methodologies are reviewed with specific emphasis on concepts, college-level engineering knowledge would suffice to understand this book. It is written in plain descriptive and illustrative terms with no extensive derivations of equations and simulations so that readers may grasp the essence of this book intuitively without resorting to numerical means. There are seven chapters

with examples from DC to RF. After fundamental issues are identified, analog performance-enhancing methods are presented repeatedly using the same principle applicable to the system-level DC servo feedback as well as the simple local feedback.

This book is mainly written and organized to give proper perspectives on the analog designs at all levels. The analog design field is built on collective achievements by numerous contributors, and apologies are extended to those whom the author failed to refer to or recognize correctly in this book.

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