Preface

The monolithic operational amplifier has become an important building block of linear integrated circuits and applications. The objective of this book is to offer the reader proficiency in the analysis and design of circuits including analog signal processing using linear ICs.

The book hopes to serve the purpose of a text to the engineering students of degree, diploma, AMIE and graduate IETE courses and a useful reference to those preparing for competitive examinations. In addition, it will meet the pressing need of those enthusiastic readers who wish to acquire a sound knowledge and understanding of the principles of linear integrated circuits. Further, the book will assist the practical analog IC designer with the selection of appropriate devices and circuit configurations. The text is presented in a simple and lucid manner with the theoretical, analytical and application aspects of ICs.

The book comprises 14 chapters. Chapter 1 discusses the various processes involved in monolithic integrated circuit fabrication, beginning with wafer preparation and culminating in encapsulation of the IC. The text also unfolds the devising of bipolar and MOS transistors, various diodes, passive components such as resistors and capacitors, transformation of an electronic circuit into equivalent monolithic form, and thin- and thick-film technologies.

In Chapter 2, the basic circuit configurations for linear ICs, such as current sources, voltage sources and references, various differential amplifier configurations using BJT, JFET and MOSFET, are discussed.

Chapter 3 dwells upon the characteristics of operational amplifiers. The popularly used op-amp 741 is introduced. The DC and AC performance characteristics, frequency compensation methods, noise characteristics, open-loop and closed-loop configurations, differential amplifiers and typical manufacturers' specifications are provided.

Chapter 4 unfolds the linear applications of op-amps from scale changer, voltage follower to instrumentation amplifier, ac amplifiers, integrator and differentiator, log and antilog amplifiers concluding with the use of linear ICs for analog computation with typical examples.

In Chapter 5, non-linear circuit applications using op-amps originating with comparators, compartmentalizing into Schmitt trigger and various applications using comparators, rectifiers, peak detectors, sample and hold circuits, clippers, clampers, and analog switches used for sample-and-hold circuits are discussed.

Chapter 6 covers the active filter design using linear ICs. First-order and second-order low-pass and high-pass filter designs, filter approximations, band-pass and band -reject filters, all-pass and state variable filters, impedance converters, impedance gyration, theory and design of various filter responses using switched capacitor filters are covered.

Chapter 7 discusses sinusoidal, square, triangular and sawtooth waveform generation circuits using op-amp, and the widely used function generator IC 8038 and timer IC 555 with typical applications.

In Chapter 8, the fundamental principles of voltage regulation, three terminal fixed voltage regulators, variable voltage regulators and their designs for high-current capability followed by the protection circuitry, theory of switched mode regulation and switched mode power supplies are covered in depth.

Chapter 9 presents various methods of obtaining analog multiplication, theory of Gilbert Cell and variable transconductance-based four-quadrant multipliers, multiplier ICs and their practical applications.

Chapter 10 demonstrates the theory of phase-locked loop covering the phase detector circuit, voltage-controlled oscillator circuit, voltage-controlled oscillator IC, closed loop analysis of PLL, a typical monolithic PLL and various applications of PLL IC 565.

In Chapter 11, the sampling theorem, the fundamentals of A/D and D/A conversion techniques, the circuit arrangements of various conversion methodologies, sigma delta conversion techniques and the widely used ICs for A/D and D/A conversion are dealt with in detail.

Chapter 12 presents the special function ICs meant for voltage and frequency conversions, tuned amplification, power amplification, video amplification, fibre optic circuits, opto-couplers, isolation amplifiers and companding processes. Insight into the ICs available for voltage and frequency conversions, function generator IC, is provided.

Chapter 13 deals with the advanced amplifiers using CMOS, BiFET and BiMOS, JFET op-amps and their analysis, and programmable transconductance amplifiers and their applications.

Chapter 14 provides an experience with simulation using PSpice for the linear integrated circuits covered in the text. The readers can familiarize themselves with the nuances of programming with PSpice.

All the topics have been illustrated with diagrams for easy understanding. Equal emphasis has been laid on mathematical derivations as well as their physical interpretations. Illustrative examples are discussed to emphasize the concepts and typical applications. Review questions and exercises have been included at the end of each chapter with a view to help the readers augment their understanding of the subject and to encourage further reading.

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We welcome suggestions for the improvement of the book.

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