Linear Microelectronic Systems

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Linear Microelectronic Systems

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and

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*Lecturers in Electronic Engineering
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Preface

The continually developing field of electronics requires a constant effort on the part of the teacher to optimise his selection from what is a vast range of topics. Somewhat in contrast, the student engineer has not only to know more about circuit techniques, amplifiers, passive networks, but also how the parts fit together to make a system and to be more adept at circuit analysis than ever before. Considering the notion that the electronic engineer constructs a system, probably by adding passive components to interconnect or modify the function of integrated circuit modules, we have tried to present such concepts and analytical techniques as he is likely to require before his creative purpose can develop.

We have collected the material for this book whilst teaching courses in circuit theory, electronics and control systems at the University of Hull. The reader will probably notice that the approach varies from formal argument to heuristic presentation of topics. Our aim has been to consider each aspect in the way most easily appreciated by the student rather than to preserve an unwieldy formality.

It has, unfortunately, been necessary to omit a certain amount of useful material. Particularly, we have avoided considering the technology of circuit integration. The construction of transistors, layout of components on the silicon chip, and trade-offs in the circuit arrangement are part of a fascinating craft that we omitted so that the text could be kept to its limited size. Neither is there much consideration of design methods in the formal sense. We hope the reader will be stimulated to follow up the references given or other suitable sources where our coverage is limited.

One feature, which we hope is evident, is that in analysing a system a mixture of inspiration, mathematical analysis and astute computing is required. To this end, computational and analytical techniques are stressed, though the reader will have to supply his own inspiration.

Chapter 1 contains analytical and computing material for use in later chapters. The concept of frequency response is introduced by means of elementary circuits in chapter 2. This leads to the ideas of complex frequency and transfer functions. These ideas are applied to simple circuits in chapter 3 where we try to stress the similarity between circuit arrangements while introducing the analysis technique of circuit modelling. In chapter 4 the elements of an amplifier are considered. We have kept in mind the differential input single ended output, voltage amplifier most often found in integrated devices. Chapter 5 goes on to consider negative feedback by which the amplifier is controlled. Negative feedback also allows the versatile use of the circuit as a functional block. Intrinsically connected with feedback is the question of stability, dealt with in chapter 6, because it is either wanted for a functional circuit or not, as in the case of an oscillator. It seems appropriate at this point to draw together the ideas variously touched on by a formal exposition of analytical methods in chapter 7. These methods are applied to larger networks in

chapter 8. Here, the use of a systems approach is exemplified by its application to analogue circuitry and to active filters. Chapter 9 is mainly concerned with practical problems in the use of integrated devices and with some applications. Material that the reader may need at various points in the text is collected in the appendixes. The first contains matrix algebra, the second signal flow analysis and the third a short glossary of integrated circuit terminology.

We would like to acknowledge the stimulation provided by our colleagues and students. Particular thanks are due to Mrs E. M. Bowen, who, with extreme patience, performed the arduous task of typing.

Hull, Yorkshire

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