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Electronic Equipment Reliability

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Second Edition

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Contents

Preface	ix
1 Introduction	1
1.1 Introduction	1
1.2 Historical survey	1
1.3 Definition of reliability	3
1.4 What is reliability worth?	4
1.5 Mean time between failures	7
1.6 The mean time to failure	8
1.7 Availability	9
1.8 Unavailability or down-time ratio	11
1.9 The effect of environment	12
1.10 Generalised definitions of failure rate and MTBF	14
2 The Mathematical Background	18
2.1 Probability	18
2.2 The classical definition of probability	18
2.3 The relative frequency definition of probability	20
2.4 Complementary events	20
2.5 Compound events	21
2.6 Joint probability for non-exclusive events	23
2.7 General addition rule	26
2.8 Conditional probability	27
2.9 Bayes' theorem	29
2.10 Probability diagrams	33
2.11 Binomial distribution	34
2.12 Examples of binomial distribution	39
2.13 The most probable outcome	42
2.14 The Poisson distribution	43

2.15	Examples of Poisson distribution	46
2.16	The exponential failure law	48
2.17	Statistics	51
2.18	The mean	52
2.19	Other measures of location	52
2.20	Variability	53
2.21	The normal distribution	54
3	Reliability Prediction	59
3.1	System subdivision	59
3.2	Reliability models	59
3.3	Failure analysis of series systems	61
3.4	Example of series system	63
3.5	Parallel systems	65
3.6	Other parallel configurations	67
3.7	Example of parallel system	67
3.8	Analysis of mixed system	70
3.9	The use of redundancy	71
3.10	Temporal redundancy	72
3.11	Error-correcting codes	75
3.12	Multichannel redundancy	77
3.13	The level of redundancy	80
3.14	Use of duplicate switching units	83
3.15	Triple redundancy	85
3.16	Comparison of duplicate and triplicate systems	86
3.17	Quadded logic	90
3.18	MTBF of redundant systems	91
3.19	Approximate methods	94
3.20	Integrated circuits	95
3.21	Design faults	98
3.22	Software faults	99
3.23	Effect of failure mode on design	100
4	Component Failure Data	103
4.1	Variation of failure rate with time	103
4.2	Types of failure	105
4.3	Factors affecting failure rate	107
4.4	The effect of temperature	108
4.5	Temperature and failure rate	109

Contents	vii
4.6 Estimating internal temperature rise	112
4.7 The effect of voltage stress	114
4.8 Environmental factors	115
4.9 The problem of measuring failure rates	116
4.10 Sources of failure rate data	117
4.11 Confidence limits and confidence level	120
4.12 Evaluating test results	121
4.13 Sequential testing	124
4.14 Environmental testing of equipment	126
4.15 Screening and failure mode analysis	129
4.16 Screening tests	130
4.17 The demand for extreme reliability	131
5 Designing for Reliability	135
5.1 Aspects of reliability	135
5.2 The effect of tolerances	136
5.3 Worst-case design of switching circuits	137
5.4 The difficulties of worst-case design	139
5.5 Statistical design	140
5.6 Component selection	141
5.7 De-rating to improve reliability	143
5.8 Assessed quality components	144
5.9 Mechanical design	147
5.10 Protection against interference and noise	148
5.11 Using redundancy	151
5.12 Maintained and non-maintained systems	153
5.13 The use of fault indicators	154
5.14 Digital fault indicators	156
5.15 Analogue redundancy	157
5.16 Parallel redundancy	158
5.17 'Fail-safe' circuits	161
5.18 Integrated circuit redundancy	164
5.19 Future trends	167
Bibliography	171
Index	175

Preface

The first detailed studies of electronic equipment reliability were undertaken to improve the performance of communications and navigational systems used by the armed services. The techniques then developed were subsequently refined and applied to equipment used for many other applications where high reliability was of paramount importance, for example in civil airline electronic systems.

Developments in electronic technology during the last two decades have also caused increased interest in reliability. For example the digital computer has evolved from a rare and somewhat unreliable device into an essential management service for most large industrial and commercial concerns, and a central element in many process- and plant-control systems. Furthermore the introduction of solid-state devices and integrated circuits has so reduced the price of electronic equipment that systems of much greater complexity are now available at economic prices. As a result of the growing contributions of these systems to many industrial and commercial activities their reliability and availability have become of great interest to the equipment user, and much more attention is now paid to these qualities in system specifications.

There is thus a need for all engineers concerned with the design, testing or commissioning of electronic systems or the components from which they are assembled to understand the factors that influence reliability, the ways in which it can be measured and specified, and the means whereby it can be improved where necessary.

This book is designed to present such information at a level suitable for students in the final year of degree and diploma courses. This is considered to be the most suitable part of the course in which to introduce the subject of equipment reliability, since any detailed consideration of the topic requires some acquaintance with many aspects of electronic

engineering. Among these are analogue and digital signal transmission and processing, circuit and system design, and component characteristics and tolerances. Although the material of the book is not developed to the level generally reached in postgraduate studies, it would be a suitable introduction to the subject, to be followed by a more detailed examination of particular topics.

Many of the calculations in the book involve simple application of the laws of probability and some knowledge of statistics. Since these topics are not included in all engineering mathematics courses a summary of the material is presented in chapter 2. Apart from this the only mathematics required are elementary algebra and simple integration.

Copies of the British Standards mentioned in the text can be obtained from the British Standards Institution, Sales Branch, 101 Pentonville Road, London N1 9ND.

Since the book was first published the development of large scale integrated circuits has significantly changed the way in which much electronic equipment is built. There has also been a marked trend towards the use of digital systems and digital methods of measurement and transmission, and the applications of microprocessors. All of these changes affect the practical aspects of assessing reliability, designing for high reliability and the effective use of redundancy.

In preparing the second edition I have included new sections dealing with these problems and also with the accompanying problem of software reliability and testing.

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