

Table of contents

Section	Page
Acknowledgement	
List of Figures.....	vi
List of Tables.....	x
Abstract.....	1
Chapter (1) Introduction for superconductors.....	4
1.1 Definition of superconductors.....	4
1.2 History of Superconductors.....	6
1.3 Advantages and limitations of superconductors.....	9
1.4 Comparison between the perfect conductor and the superconductor.....	10
1.5 Superconductor Types	11
1.6 Characteristics of high temperature superconductors (HTS).....	12
1.6.1 Superconducting properties.....	13
1.6.2 Superconducting materials and substrates.....	13
1.6.3 Complex conductivity.....	16
1.6.4 Penetration depth and skin depth.....	17
1.6.5 Surface impedance of superconductors.....	18
1.6.6 Nonlinearity of superconductors.....	20
1.7 Applications for superconductors.....	21
1.8 Summary	26
Chapter (2) Basic concepts of filter networks and microstrip lines	27

Section	Page
2.1 Network variables.....	27
2.2 Scattering parameters.	28
2.3 Short circuit admittance parameters.....	31
2.4 Open circuit impedance parameters.....	31
2.5 ABCD parameters.....	32
2.6 Network connections.....	34
2.7 Transmission lines.....	36
2.7.1 Transmission line structure.....	36
2.7.2 Transmission line design equations.....	37
2.8 Microstrip lines	39
2.8.1 Microstrip Structure	39
2.8.1.1 Effective Dielectric Constant (ϵ_{re}) and Characteristic Impedance (z_c)	39
2.8.1.2 Guided Wavelength	41
2.8.1.3 Propagation Constant	41
2.8.1.4 Phase Velocity	42
2.8.1.5 Effect of dispersion	42
2.8.1.6 Electrical Length	43
2.8.1.7 Strip thickness	43
2.8.1.8 Microstrip losses	44
2.8.1.9 Effect of enclosure	45
2.8.1.10 Effect of characteristic impedance and dielectric constant on w/h	45
2.9 Strip line	45
2.10 Coupled Lines	47

Section	Page
2.10.1 Even and Odd mode capacitances	48
2.10.2 Even- and odd-mode characteristic impedances and effective dielectric constants	49
2.11 Microstrip discontinuities	50
2.12 Other types of Microstrip lines	50
2.13 Microstrip components	51
2.14 Summary	52
Chapter (3) Design and implementation of superconducting microstrip narrowband bandpass filter	53
3.1 Introduction	53
3.2 Characteristics of filters	54
3.3 Transfer function for lowpass filters	55
3.3.1 Butterworth (Maximally Flat) Response	55
3.3.2 Chebyshev Response	56
3.3.3 Elliptic Function Response	58
3.3.4 Gaussian (Maximally Flat Group-Delay) Response	59
3.3.5 All-Pass Response	60
3.4 General design procedures for the lowpass and bandpass filters	62
3.4.1 Lowpass prototype filter	62
3.4.2 Frequency and element transformation	64
3.4.2.1 Lowpass transformation	64
3.4.2.2 Bandpass transformation	65
3.4.2.3 Lowpass to bandpass transformation	66

Section	Page
3.5 Immittance inverters	66
3.5.1 Definition of Immittance, Impedance, and Admittance Inverters	66
3.5.2 Filters with immittance inverters	68
3.6 Different design cases	72
3.6.1 Design of case (1)	72
3.6.2 Design of case (2)	74
3.6.3 Design of case (3)	76
3.7 Bandpass Filter Implementation using the microstrip	78
3.7.1 End-Coupled, Half-Wavelength Resonator Filters	78
3.8 Conclusion	89
Chapter (4) Design and implementation of superconducting microstrip broad band filter for mobile communication systems	91
4.1 Introduction	91
4.2 Filter design characteristics	91
4.3 Richards' transformation and Kuroda identities	91
4.3.1 Richard transformation	92
4.3.2 Kuroda Identities	94
4.4 Broadband bandpass filter	98
4.5 Optimization and least square curve fitting	102
4.6 Conclusion	113

Section	Page
Chapter (5) Conclusions and Future work	114
5.1 Conclusions	114
5.2 Future work	115
References	116
Appendix	119