CONTENTS

DEDICATION ......................................................... i
ACKNOWLEDGEMENTS ........................................... ii
CONTENTS ............................................................. v
LIST OF FIGURES .................................................. x
LIST OF TABLES ..................................................... xv
LIST OF ABBREVIATIONS AND SYMBOLS ...................... xvi
LIST OF APPENDICES ............................................. xviii
ABSTRACT ............................................................ xix

CHAPTER 1

1. Introduction ..................................................... 2
1.1 Literature survey .............................................. 3
   1.1.1 Grounded Inductance Realization using single op-amp Type-I ......... 5
   1.1.2 Grounded Inductance Realization using single op-amp Type-II ........... 6
   1.1.3 Grounded inductor Simulation using two op-amp ......................... 7
   1.1.4 Realization of Grounded FDNR from GIC –Method I ..................... 8
   1.1.5 Realization of FDNR and Floating FDNR-Method II ..................... 9
1.2 Formulation of the problem ................................... 11
1.3 Scope of the Thesis .......................................... 12
1.4 Organization of the Thesis ................................... 14

CHAPTER 2

2 Simulated inductor using GIC and its application in the synthesis of
   Butterworth Analog filters
2.1 Introduction ................................................................. 16
2.2 Inductor simulation circuit ........................................... 17
2.3 Experimental validation of simulated L ............................ 19
2.4 Analog filters ............................................................... 20
   2.4.1 Butterworth filters .................................................. 21
   2.4.2 Basic LCR resonator circuit ...................................... 21
   2.4.3 Realization of Butterworth filters using LCR resonator circuit ........ 22
   2.4.4 Realization of low pass filter .................................... 23
   2.4.5 Design of low pass filter ........................................ 24
   2.4.6 Realization of high pass filter ................................... 25
   2.4.7 Design of high pass filter ....................................... 27
   2.4.8 Realization of band pass filter .................................. 28
   2.4.9 Design of band pass filter ....................................... 29
   2.4.10 Realization of notch filter ...................................... 30
2.5 Applications of Butterworth filter at low frequencies .......... 32
2.6 Conclusion ................................................................. 32

CHAPTER 3

3 Simulated L using GIC and its application in the synthesis of Analog Bessel filters
3.1 Introduction ................................................................. 34
3.2 Bessel filters ............................................................... 34
   3.2.1 Realization of Bessel low pass filter ............................. 35
   3.2.2 Design of Bessel low pass filter ................................. 37
CHAPTER 4

4 Synthesis of analog filters using Frequency Dependent Negative Resistance

4.1 Introduction ................................................. 45

4.2 FDNR realization using basic GIC ........................... 45

4.3 Synthesis of low pass filter using FDNR ....................... 47
  4.3.1 Transformation using Capacitance Resistance D-element (CRD) ............ 47
  4.3.2 Realization of low pass filter using FDNR ........................... 47
  4.3.3 Design of low pass filter using FDNR ............................. 48

4.4 Realization of Notch filter from band pass filter .................... 51
  4.4.1 Design of notch filter using band pass filter ...................... 52
  4.4.2 Implementation of Notch filter ................................. 52

4.5 Conclusion .................................................. 54

CHAPTER 5

5 Low frequency tuned amplifier and oscillator using simulated Inductor

5.1 Introduction .................................................. 56

5.2 Single tuned amplifier ........................................... 57
  5.2.1 Design of Single tuned amplifier and Simulated L ..................... 58
5.3 Hartley and Colpitts oscillator ................................................. 58
  5.3.1 Design of Hartley and Colpitts oscillator with simulated L ................. 60
5.4 Active tuned oscillator using band pass filter ..................................... 62
  5.4.1 Basic Active tuned oscillator .................................................. 62
  5.4.2 Design of band pass filter using simulated L .................................. 63
  5.4.3 Design of active tuned oscillator using simulated L ......................... 64
  5.4.4 Active tuned oscillator using Simulated L .................................... 64
  5.4.5 Effect of Quality factor ......................................................... 67
5.5 Conclusion .............................................................................. 73

CHAPTER 6

6 Improved LC filter in class D audio power amplifier using simulated inductor
  6.1 Introduction ................................................................. 75
  6.2 Working of class D audio power amplifier ....................................... 75
  6.3 Disadvantages of using LC filter in class D audio power amplifier .......... 77
  6.4 Construction of class D audio power amplifier using simulated L .......... 77
  6.5 Design of the complete circuit of class D audio power amplifier using simulated L 79
  6.6 Experimental results and discussion .............................................. 79
  6.7 Conclusion ........................................................................... 82

CHAPTER 7

7 Synthesis of analog filters, oscillator and tuned amplifier using the newly
  proposed SUJA simulated inductor
  7.1 Introduction ................................................................. 85
  7.2 Basic circuit to simulate L ..................................................... 86
7.3 Concept of negative resistance ........................................... 86
7.4 Simulation of the newly proposed SUJA simulated inductor using negative resistance ................................................................. 87
7.5 Application of the newly proposed SUJA simulated inductor in analog filters ...... 89
  7.5.1 Synthesis of high pass filter ............................................. 89
  7.5.2 Synthesis of band pass filter ........................................... 91
  7.5.3 Synthesis of notch filter .................................................. 92
7.6 Design of the filters using the newly proposed SUJA simulated inductor .......... 94
7.7 Application of the newly proposed SUJA simulated inductor in oscillator ....... 94
7.8 Design of the oscillator using the newly proposed SUJA simulated inductor ..... 95
7.9 Application of the newly proposed SUJA simulated inductor in tuned amplifier .. 96
7.10 Design of the tuned amplifier using the newly proposed SUJA simulated inductor 97
7.11 Conclusion ................................................................. 97

CHAPTER 8

8 Conclusion

8.1 Introduction ............................................................... 100

8.2 Future work ............................................................... 101

REFERENCES ................................................................. 103

APPENDICES ................................................................. 112