CHAPTER 8

Conclusion
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8.1 Introduction

The use of the passive component namely the inductor is very much constricted in analog circuit applications. The reasons are

1. The magnetic material forming the core and the conductors forming the windings of the inductor must be deposited on the semiconductor surface of ICs. This arrangement results in inductors of very low inductance $L$ and poor quality factor $Q$.

2. The physical size of an inductor and its quality factor creates a size problem. Thus, reduction in size of inductor reduces the quality factor greatly.

3. Even large inductors have losses.

4. The size and weight of inductors become exceedingly large and $Q_L$ becomes very low. Hence, inductors are seldom used at such low frequencies.

5. Inductors using ferromagnetic materials are basically nonlinear elements. Hence, unless the amplitude of the signal which they handle is kept small and direct currents are avoided, the inductors generate harmonic distortion.

6. Inductors tend to act as small antennas, radiating as well as picking up electromagnetic waves. This can result in undesirable noise and coupling of signals in circuits containing inductors.

7. The inductors cannot be fabricated on ICs. This difficulty arises due to the fact that the IC fabrication techniques are layer oriented which typically involve processes which are applied to multiple horizontal surfaces in a sequential fashion. However the inductive circuit has a "non-planar" configuration which typically has a continuous spiral shape. This
particular spiral configuration thus prevents the IC fabrication to integrate the inductive
circuits as part of the IC devices. Hence it is not compatible with latest IC technology.

To eliminate all the above mentioned disadvantages, two circuits for simulating
L are proposed. The first one is for simulating the ideal L which is grounded. In case the
inductor is not grounded, a modified circuit using FDNR concept and some other methods are
proposed. The second one is for replacing the inductor which has losses by an ideal inductor
by introducing the concept of negative resistance.

The various applications of such simulated L is discussed .They are (i) analog
filters which includes low pass filter, high pass filter, band pass filter, band stop filter and all
pass filter (ii) active tuned amplifier (iii) audio class D power amplifier (iv) oscillators like
Colpitts and Hartley etc. Some of the simulated results are validated also.

The benefits of using the proposed simulated L are i) it can be fabricated on ICs which is
attuned with latest IC technology.ii) the size of simulated inductors is small compared with the
conventional inductor.iii) There is no EMI problem and the quality factor tends to be infinity.

8.2 Future work

Out of the three passive components, the disadvantages of using L are eliminated by
the proposed methods mentioned in the thesis. The future work is that the resistor may also be
simulated since the use of high values of resistors poses some problems like (i) fabrication of
resistors on ICs corresponding to integrated diffused resistors which have poor temperature
and linearity characteristics. (ii) Large value of resistors occupies more space. The switched
capacitor filter offers an alternate solution which is proposed in the conventional RC active
filter. The problem associated with this, is the selection of clock frequency for MOSFET switches. The future work is the simulation of resistors for values greater than or equal to 10 KΩ by changing (W/L) ratio of the switches and its applications in analog circuits.