STUDIES ON RING OSCILLATOR AND ITS APPLICATIONS IN COMMUNICATION SYSTEMS

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Doctor of Philosophy in Science

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PREFACE

This thesis includes the studies carried out by the author on the design of ring oscillator and its applications in synchronous systems. The basic of these studies is to investigate the linear and nonlinear characteristics of ring oscillators and apply it to different systems often used in electronic transceivers. In the first step, we have attempted to design a variable length ring oscillator with optimum propagation delay with length control and frequency tuning facilities. The length of the oscillator is controlled by a digital circuit which will take negligible time and is responsible for wide change in frequency. Such oscillator is applied in phase lock loop as a voltage control oscillator to design frequency synthesizer and clock recovery circuit. The frequency synthesizer is capable of producing even multiple of the reference frequency. The output of the clock recovery circuit is the hidden clock in the pseudo noise signal. On the other hand, the nonlinear characteristics of the coupled ring oscillator is explored numerically and experimentally. The differential equations of the coupled oscillator is used to generate chaotic sequences to apply in cryptography. Finally, we have presented one DNA based encryption algorithm to encrypt RGB colour image of arbitrary size. The cryptanalysis confirmed the validity of the algorithm. The thesis reports the results of MATLAB simulation and experimental studies carried out to establish the validity of the above mentioned design algorithms. However, the electronic circuits of variable length ring oscillator, frequency synthesizer and clock recovery are designed using commercially available discrete electronic components at the lower end of the RF spectrum. But the circuit design algorithms are applicable for higher range of the RF spectrum in the integrated versions or in monolithic IC.