

## 1- MSC :-

### **Analysis and Design of High Performance RTD-CMOS Dynamic Logic Circuits Thesis**

#### **Abstract**

Rapid development in the fields of computers and communications leads to the need for high speed processors. The continuing miniaturization of the conventional CMOS technology faces increasing technological difficulties. Therefore, alternative technologies are needed to provide the required fast processors.

Technologies that contain Resonant Tunneling Diodes (RTDs) can offer a good alternative for high speed applications. RTD has many advantages that make it a promising device. Its operation depends on the tunneling process, which is a very fast process, so it is a suitable device for ultra-high speed applications. Its negative differential resistance (NDR) property makes a remarkable reduction in logic circuits' complexity. RTDs can also be integrated with CMOS technology to improve dynamic CMOS circuits' performance.

Dynamic logic circuits have a higher performance and lower circuit area than their static CMOS counterparts, but they are less noise tolerant. The noise tolerance can be improved using some remedial techniques, such as employing a keeper, on the cost of noticeable performance degradation. RTD-CMOS topology called "smart keeper" was proposed to reduce this performance degradation.

In this work, a brief discussion about RTD modeling is introduced, and different models of I-V and C-V characteristics of RTD are discussed. A simple and accurate SPICE model for RTD is proposed. In addition, a straightforward parameters' extraction routine is provided. Then, some important applications of RTD like oscillator and inverter are simulated using the proposed model. A new and effective relationship for sizing of the smart keeper, to achieve a desired I-V characteristic, is derived, verified, and used to design the smart keeper. Then, an overview and classification of the most recent noise-tolerant design techniques of dynamic logic circuits are presented and compared with the smart keeper technique.

A Dual-Rail Domino full adder with the smart keeper is proposed and analyzed using the proposed model in this work

#### **Paper:**

**An accurate large-signal SPICE model for Resonant Tunneling Diode.**

## Abstract:

Resonant Tunneling Diode (RTD) is a promising device that can be used in the design of ultra-high speed circuits. Also the Negative Differential Resistance (NDR) characteristic of RTD showed a significant reduction in logic circuits' size and complexity. This paper proposes a new accurate and less complexity large signal RTD SPICE model for analyzing circuits containing RTD. In addition, a straightforward parameters extraction routine using MATLAB program is developed. Some important applications are simulated and verified using the new model.