

  
**Extracting the Characteristics of Circuits**  
**UNIVERSITY of ARKANSAS**

Teuta Klari, [tklari@uark.edu](mailto:tklari@uark.edu)  
Faculty Advisor: Dr. Alan Mantooth

**ABSTRACT** The focus of this research is the design of a fully integrated 5 GHz LC BiCMOS Voltage Controlled Oscillator (VCO). The preliminary work includes the research of a fully integrated 2.5GHz LC CMOS VCO, which is fabricated in 0.35 $\mu\text{m}$  single poly, 4 metal, 3.3V CMOS process available through MOSIS. The final product, which will be implemented in SiGe process, is intended for RF/wireless applications.

**BACKGROUND** The modern radio and radar systems brought the need to provide stable harmonic oscillation at particular frequencies. The challenge of providing such circuits lies in the fact that we are trying to exploit non-linear circuit behavior by using linear system tools. At the same time, the ever-growing applications of wireless products have lead to increasing demands for products that require small area and low power. So, to the complexity of designing oscillators is added the need for small area and low power.

While there are many types of oscillator circuits, the VCO is studied in detail because of its importance as a building block in RF systems.

**WORK DONE** The 2.5GHz VCO, designed by Ryan Lee Bunch at Virginia Polytechnic Institute and State University, is used as a guide in understanding the design process of a VCO. A closer look is taken at the theory of operation of CMOS transconductance oscillators, on which this VCO designed is based. Also, mathematical reasoning and simulations are used to design and predict the behavior of the inductors and the varactor that constitute the LC tank of the circuit.

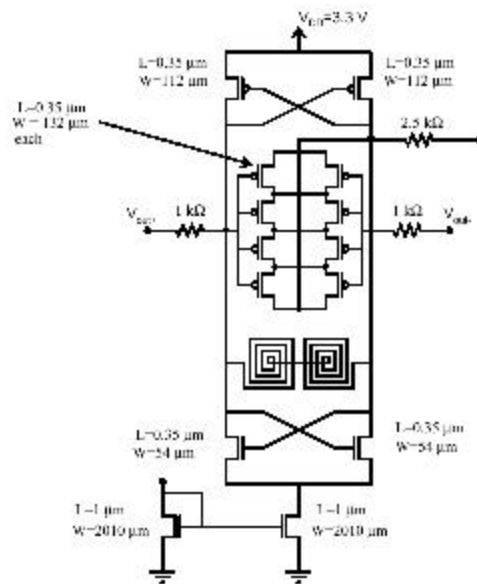


Fig.1 2.5GHz Unbuffered VCO circuit schematic

**Future Work.** The next step is reproducing the results obtained from the 2.5GHz VCO. The circuit will be fully simulated and fabricated in 0.35 CMOS process. The benefit of fabrication run lies in the appreciation gained from layout and testing issues. This will assure a more educated and confident approach in designing the final product in SiGe.