Behavioral modeling of inductively coupled oscillators.

D. Harutyunyan J. Rommes W. H. A. Schilders

September 8, 2008

1 Introduction

The design of modern RF integrated circuits becomes increasingly more complicated due to the fact that more functionality needs to be integrated on smaller physical area. In the design process floor planning, i.e., determining the locations for the functional blocks, is one of the most challenging tasks. Modern RF chips for mobile devices, for instance, typically have an FM radio, Bluetooth, and GPS on one chip. Each of these functionalities are implemented with Voltage Controlled Oscillators (VCOs), that are designed to oscillate at a certain frequency. In the ideal case, the oscillators operate independently, i.e., they are not perturbed by each other or any signal other than their input signal. Practically speaking, however, the oscillators are influenced by unintended (parasitic) signals coming from other blocks (such as Power Amplifiers) or from other oscillators, via for instance (unintended) inductive coupling. A possible undesired consequence of the perturbation is that the oscillators lock to a frequency different than designed for, or show pulling, in which case the oscillators are perturbed from their free running orbit without locking.

During floor planning, it is of crucial importance that the blocks are located in such away that any perturbing signals are minimized. A practical difficulty here is that transient simulation of the full system is very expensive and usually unfeasible during the early design stages. One way to get insight in the effects of inductive coupling and injected perturbation signals is to apply the phase shift analysis [1]. In this talk we will explain how this technique can be used to estimate the effects for perturbed individual and coupled oscillators.

References

[1] Xiaolue Lai and J. Roychowdhury, *Capturing oscillator injection locking via nonlinear phase-domain macromodels*, Microwave Theory and Techniques, IEEE Transactions on **52** (2004), no. 9, 2251–2261.