DESIGN OF CLASS-E RF POWER AMPLFIER

Abstract

With wireless communication moving from the 4^{th} to the 5^{th} generation and beyond, mobile equipment with a high data rate, low cost and full integration will be in great need. Unfortunately, PA efficiency is a significant issue for the overall performance of most wireless system in term of area, cost, battery lifetime and output power. Therefore, the design of a high-efficiency PA is the most obvious solution to overcoming the battery lifetime limitation in the wireless systems.

The complementary Metal-Oxide-Semiconductor (CMOS) technology features low cost, low power consumption and high integration. With a scaled fabrication process, it has been proven to be capable of offering promising RF performance comparable to that of III-V technology. As a result, there is increasing interest in using CMOS technology to realize transceiver building blocks such as power amplifier (PAs). Nevertheless, due to CMOS device limitations such as a low cut-off frequency and high parasitic capacitance, the circuit performance is limited.

In spite of its limitation, sub-micron CMOS prove to be the best process to implement the PA operating at frequency up to few GHz range. Therefore, the focus of this project is to design a high efficiency class-E PA which meets the output power, linearity and gain requirements of a mobile communication system and at the same time integrated in CMOS technology without any need for off-chip components. To achieve this goal, a theoretical foundation is first developed. It investigates the consequence of CMOS integration with respect to power amplification.

Publications

Alfred Lim, Aaron Tan, Zhi Hui Kong, Kaixue Ma, Kiat Seng Yeo, “A 2.4-Ghz Transformer-Based Class-E Power Amplifier in 65nm CMOS Technology” *Submitted*

A. Lim, K. Ma, Z. H. Kong and K. S. Yeo, "Transformer-based class-E CMOS PA with shunt LC network," *2015 International SoC Design Conference (ISOCC)*, Gyungju, 2015, pp. 205-206.

Alfred Lim, Kaixue Ma, and Yeo Kiat Seng, “Transformer-Based Class-E CMOS Power Amplifiers”, *4th IEEE International Symposium on Next-Generation Electronics (IEEE ISNE 2015), May, 2015.*

Alfred Lim, Aaron Tan, Zhi Hui Kong, Kaixue Ma, Kiat Seng Yeo, “Theoretical Analysis of Transformer-Based Class-E Power Amplifier in 65nm CMOS Technology” *Pending Submission*

Aaron Tan, Rui Tze Toh, Yongfu Li, Alfred Lim, Zhi Hui Kong, Kaixue Ma, Kiat Seng Yeo, “A Methodology To Evaluate Circuit Complexity: Doherty Power Amplifier As A Case Study” *Submitted*