FRIEDRICH-ALEXANDER
UNIVERSITÄT
ERLANGEN-NÜRNBERG

TECHNISCHE FAKULTÄT

Elektrotechnik-Elektronik-Informationstechnik

EEI KOLLOQUIUM

Highly-Integrated Millimeter-Wave Circuits for Radar and Communication Applications

Dr.-Ing. Vadim Issakow
Infineon Technologies, München

Dienstag, der 06.12.2016, 13^{00} Uhr
Tietze-Schenk-Saal, Cauerstraße 9, Erlangen

Diskussionsleitung: Prof. Dr.-Ing. R. Weigel

As the demand for higher level integration continuously increases, the realization of system on chip (SoC) in silicon-based technologies becomes inevitable. This talk presents an overview of integrated millimeter-wave circuits in silicon-based CMOS, SiGe HBT and BiCMOS technologies with their related applications operating at frequencies ranging from 24 GHz to 90 GHz. Application related circuit design challenges are discussed.

First, a highly-integrated low-power radar transceiver in 0.13-µm CMOS for 24-GHz automotive applications is presented. The integration level includes an LNA, two mixers, polyphase filters, a VCO, a Power Amplifier (PA) driver and frequency division by four. The challenges due to high ESD requirements and technology limitations are addressed by circuit techniques. Additionally, an equivalent 24-GHz radar chipset is implemented in a 0.35-µm SiGe bipolar technology for performance comparison.

Next, this talk addresses design of a robust programmable low-power frequency divider chain for high-datarate communication systems up to 90 GHz. Several test chips realized in 28-nm CMOS, 40-nm CMOS and 0.13-µm BiCMOS technologies are presented. Various inductorless speed enhancement techniques are discussed: gate-drain capacitance neutralization; differential negative capacitance at the D-latches and “keep-alive” technique for asymmetrical bias of a D-latch to tune the divider operation between static and dynamic modes.

Further, an ultra-wide tuning range low phase noise dual-core 60GHz VCO for radar applications is discussed. Gesture sensing application poses very stringent requirements on the absolute value of phase noise to achieve highest resolution. Once the highest quality factor of the tank and highest voltage swing are achieved, the only way to further improve the absolute phase noise value is by coupling several VCO cores. Hence, we describe circuit techniques to couple several VCO cores. Measured results of the test chip realized in 40nm CMOS are presented.

Finally, this talk gives a brief outlook on future mm-Wave circuit design challenges related to emerging applications.