Project description

Recent advances in semiconductor technologies, circuit techniques and circuit topologies allow using integrated circuits at mm-wave frequencies. The range between 30GHz and 300GHz has been associated to mm-wave frequencies in the spectrum. The main advantages operating at mm-wave frequencies are small form-factors, possibility to use large bandwidth and specific properties in interaction with materials. Therefore, mm-wave integrated circuits are used in application as high data-rate communications, radar and non-destructive material inspection. Next to main stream high data-rate 5G or 6G communications, high frequencies allow small antenna size making wireless chip-to-chip communications feasible. In automotive radar, both high carrier frequencies and large bandwidth allow for resolution improvements and very compact radar modules including integrated antennas.

Frequency generation and distribution becomes very challenging when operating at mm-wave. Conventional techniques for design and implementation of phased-locked loops (PLL) operating at lower frequencies need significant adaptations and improvements in order to be applied at mm-wave frequencies. In oder to meet link budget requirements mm-wave transceiver employ multiple paths or even multiple chips in the frame of MIMO or beamforming concepts. Hence, the frequency distribution aspects need to be taken into account as well.

The aim of this project is research into frequency generation and distribution concepts for communication and radar transceivers operating around 150GHz. After selecting suitable concepts the trade-offs between phase noise (relevant for communication systems), frequency linearity versus time (relevant for FMCW radar systems), robustness and power consumption need to be investigated. Finally, suitable building blocks topologies need to be chosen following by design, implementation and characterization of entire frequency generation system.

The work on frequency generation and distribution sub-system will be carried out in close collaboration with the activities on receive and transmit signal paths. The people working on receive/transmit signal paths and frequency generation/distribution will form mm-wave team within IC design group. The final goal is design, implementation and characterization of 150GHz transceiver for high data-rate communication or sensing (radar) applications. IC design group offers access to modern semiconductor technologies, state of the art tools for design and implementation of analog integrated circuits and very advanced lab facilities.

Required student background and profile

- Master Degree in Electrical Engineering
- Experience in design and implementation of analog integrated circuits is a plus
- Experience in using Cadence, Spectre, ADS/Momentum, Matlab is a plus
- Highly motivated student, eager to discover and explain new phenomena
- Passion for improving performance of analog integrated circuit operating at high frequencies
- Fast learner, autonomous and creative, highly motivated, persistent and dedicated
- Good communication skills and willing to work with different people
- Fluent in English, both spoken and written

Supervision

This PhD position is supervised by Dr.Ir Vojkan Vidojkovic. Dr. Ir. Marion Matters and Dr.Ir. Peter Baltus will also be available for discussions and for providing advice. Vojkan, Marion and Peter have proven track record in field of analog/RF/mm-wave integrated circuits in industry and academia.

Professional environment - IC Design Group

The research area of the group is advanced purely-analog and mixed-signal IC design (RF/IF/LF), applied to frontends, especially for wireless RF transceivers and sensors. In this context, frontends are defined as the functional blocks that process and translate analog signals (communication signals, sensor signals) to digital signals (bits), and vice versa, see the figure below. This includes on the one hand system, concept and algorithm level design, and on the other hand circuit block design (antenna-

matched low-noise amplifiers, sensor amplifiers, power amplifiers; oscillators, mixers, modulators, detectors; data converters). At all these levels, we strive to implement smartness (autonomous calibration, adaptivity, error correction, reconfiguration, etc.). As regards performance, we focus on improvements in speed (up to THz), power-efficiency, and ultra-low-power. As regards the application domains, our current focus is on communication systems, sensor systems, and medical systems. As regards technology, we focus on advanced deep-submicron processing (CMOS, BICMOS), emerging technologies (organic electronics, metal oxides), and THz technology.

Application

Please contact Vojkan Vidojkovic (v.vidojkovic@tue.nl) for additional information and detailed project information.

If interested, please use the 'apply now'-button at the top of this page. You should upload the following:

- a brief cover letter motivating your interest and suitability for the position
- a detailed curriculum vitae including research experience and any previous publications
- transcripts of academic records indicating courses taken (including grades)
- half-page summary of your MSc thesis
- contact details of two relevant references (email, phone number)

Please note that you can upload 1 document of 10 MB. So if you have more than 1 document you will have to combine them. Screening of applications will start as soon as applications are received and will continue until the position has been filled.

Applications by e-mail are not accepted!