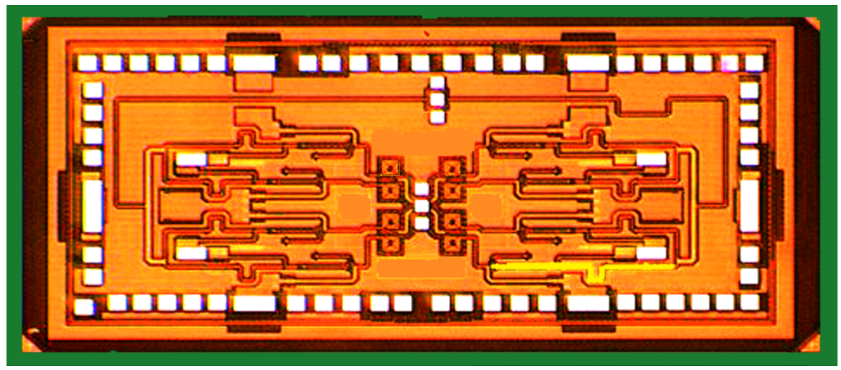
Professors Krishnaswamy and Kinget Win $1.13M DARPA Contract to Develop One-Chip-Fits-All Wireless Technology



45GHz watt-class reconfigurable waveform-adaptive power amplifier IC in 45nm SOI CMOS - an early prototype of a field-programmable power-amplifier architecture that the researchers hope can be adapted to many different applications

Electrical Engineering Professors Harish Krishnaswamy (http://www.ee.columbia.edu/~harish/) and Peter Kinget (http://www.ee.columbia.edu/~kinget/index.html) have been awarded a four-year, $1.13 million DARPA (Defense Advanced Research Projects Agency) contract to develop new design approaches that will enable a single wireless chip to perform the various different functions required from our handheld electronic devices.

"We are very happy to receive this award as it enables us to work on a very important piece of research," says Krishnaswamy, who is leading the Radio Frequency Field Programmable Gate Arrays (RF-FPGA) project. He points out that, while electronics technology has revolutionized wireless communications through cellular phones and Wi-Fi, one of the major challenges with wireless electronics is that it is still hard to make a single chip work for many different applications.

“In your cellphone,” he says, “you need separate chips for GSM, CDMA, Wi-Fi, Bluetooth etc. So we are hoping to design a single wireless chip that can do it all - and thus make future wireless electronic devices significantly smaller, cheaper, and more power efficient."

The research—"CMOS RF Field-Programmable Full-Duplex T/R Module"—is funded through DARPA’s RF-FPGA program. The goal of this program is to develop field-programmable, fully adaptable, and waveform-agnostic integrated RF front-ends and associated design tools for next-generation wireless platforms.

Harish Krishnaswamy

Peter Kinget

“The power amplifier, namely the block that transmits a large amount of power so that the signal can reach a far-off base station, is one of the most challenging blocks in a wireless transmitter,” Krishnaswamy notes. “One of the challenges is making a ‘one-chip-fits-all’ power amplifier that can work for a wide variety of wireless applications, each with its own frequency of operation, waveform, and power level. We are investigating a new field-programmable power-amplifier architecture that can be adapted to many different applications.”

“To build a one-chip-fits-all receiver, the biggest challenge resides in designing very sensitive amplifiers that are very low noise but at the same time can handle very large interfering signals reaching the receiver from other neighboring wireless terminals,” adds Kinget. “Being able to handle this interference in a programmable way is a key focus of our research in the RF-FPGA program.”

Krishnaswamy and Kinget are also working on several other DARPA projects. They are collaborating with the University of Texas at Austin on DARPA's CLASIC (#_msocom_1) (Cognitive Radio Low-Energy Signal Analysis Sensor ICs), a program that is exploring new cognitive wireless systems that will automatically figure out which other wireless systems are in the surrounding environment and how to co-exist without interfering with them.

"This is further going to be a key technology to relieve the spectrum shortage that we are facing as more and more people are using data heavy smart phones," says Kinget. "Instead of relying on a fixed usage for various parts of the spectrum, wireless devices will find unused spectrum and use it opportunistically when downloading large amounts of data."

In addition, Krishnaswamy is working on DARPA's ELASTx (Efficient Linearized All-Silicon Transmitter ICs) and the Young Faculty Award (YFA) programs, also related to wireless electronics. This research is focused on investigating new regions of the spectrum, especially millimeter-wave (30-300GHz) and terahertz (above 300GHz), that could enable electronic wireless devices with 10 to 100 times more bandwidth than the devices that are available today.

—by Holly Evarts

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