CATRENE Innovation Award 2013

PANAMA's significant contribution to communications makes it a winner

The Power Amplifiers and Antennas for Mobile Applications project (PANAMA), part of the CATRENE Programme, was chosen 2013 winner of the CATRENE Innovation Award for its outstanding work in a number of key communications application areas and allied technologies. This award was presented on November 27 at the European Nanoelectronics Forum 2013 in Barcelona.

Why PANAMA?

The use of mobile phones keeps growing as manufacturers and service providers expand mobile-related functionality and applications (apps). And as European citizens increase their appetite for mobile communications, their need for 24/7 access to communication services everywhere is also on the rise. This means more extensive use of high-capacity wireless networks, and communications systems with dynamically reconfigurable multi-standard, multi-mode capabilities.

Furthermore, new intelligent solutions are needed to reduce energy consumption (a political and social issue), based on intelligent power components exploiting highly-innovative semiconductor and nano-electronic technologies.

An assessment of communications versatility and power efficiency shows that the power amplifier is the key component in the communications chain that could help achieve these objectives. However, advances in amplifier technologies need to be considered in the overall context of the communications system to ensure comprehensive efficiency improvements, rather than simply transferring the problem elsewhere.

Clear objectives

PANAMA set out to address these needs with the use of integrated systems, discrete systems and distributed systems (co-located with the aerial), and applied to a set of target applications, such as 3G/4G and millimetre-wave mobile communications handsets and transceiver base stations, avionics, mobile satellite communications and home networking.

The primary target was an efficiency gain of 20% for integrated systems, 30% for discrete systems and 10% for distributed systems. In addition, PANAMA relied on the development of innovative enabling tools in the measurement, modelling and simulation areas to enable a breakthrough in design flow.

Innovative response

PANAMA, which ran from January 1, 2009 to September 30, 2012 and comprised 20 partners from industry and academia in France, Belgium, The Netherlands and Spain, achieved all its initial project goals, a significant achievement. Internal collaboration was excellent, ensuring a smooth and successful operation.

More 'visibly', PANAMA has made possible handsets that are even more energy-efficient, faster, and capable of higher-capacity internet connections through more access-points – catering to mobile users' even greater appetite for mobile and web services.

Furthermore, not only did PANAMA meet the efficiency gains it set out, but all (power-efficiency) techniques and methods (pertaining to integrated and discrete systems dedicated to 2G/3G mobile applications, home networking, base stations, airborne and sitcom) that were developed or optimised surpassed their expected efficiency targets:

- For envelope elimination and restoration and envelope tracking methods at 1.95 GHz, efficiency increased from 35% to 49% (expected target was 42%);
- For envelope tracking and power cell switching techniques at 2.4GHz, efficiency went from 10% to 15% (expected target was 12%);
- For the outphasing method at 60 GHz, efficiency increased from 14% to 25% (expected target was 16.8%).

There were other positive project outcomes. The newly developed architecture and design methodology will lead to future improvements in transmission efficiency. The nonlinear models are now more accurate, and improved extracted models led to a jump in the efficiency rating (PAE) of power amplifiers from 10% to 15%. Furthermore, model extraction is now easier to perform, and simulation tools simpler and faster to use.

Project impact and outlook

The more obvious impact of PANAMA can be found in the mobile communications and allied industries, as described earlier. But this project has wider implications, now and in the future.

PANAMA's industry partners issued 14 patents and the project's innovative deliverables are also available to, for example, European integrated circuit (IC) manufacturers and system providers who can deploy them as part of their defence against external competition from abroad.

From an academic point of view, universities and research laboratories increased their expertise through the 15 PhD students trained in PANAMA, the three patents issued, and the 137 papers published in prestigious journals or presented at international conferences. In addition, standards established during joint-development work on Beamformer and down-tilt antenna for base stations, for example, have been submitted for acceptance to the respective international standards group.

Some deliverables and contacts even had commercial consequences outside the actual project, like the start-up created by one of the universities to commercialise the active harmonic load-pull test setup developed in the project. Its first customer was a PANAMA partner.

And finally, the transfer of expertise from academic partners to industry is also going well. More generally, there are several cases where architectures and circuit components developed through the collaboration between university and industry are being deployed by the industry partner.

The CATRENE Innovation Award

Established in 2010, the CATRENE Innovation Award (previously known as the MEDEA+ Innovation Award), is conferred on projects with a high level of innovation and far-reaching exploitation potential, market impact and overall benefits for Europe, as well as, creative objectives and effective management.

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