Connecting Bits to Life

PETER KINGET

Professor of Electrical Engineering

We live and work in a digital society, surrounded by cell phones, laptops, cameras, iPods, and other electronic devices constantly in use. And the desire for more automation, more information, and more broadband access with better, faster, cheaper mobile infrastructure continues to increase exponentially across the globe. But the physical world around us is analog. Music, speech, images, physiological signals, radio waves, any physical signal is continuous in time and in value. As our information society transitions to more and more digital media and communications, the need for interfaces between real-world analog signals and digital signals (bits) keeps growing drastically. For instance, voices need to be converted to digitized pulses and vice versa on cell phones, music has to be translated into bits for storage and converted back to sounds we can enjoy, and images on digital cameras need to be changed to digitized pixels and then reversed.

The challenge is how to keep all our digital devices connected to the real world with better quality, more pixels, more bits, while needing less—less space, less energy, and less cost. Peter Kinget is one of the researchers leading the way in, as he puts it, "connecting bits to life."

Kinget's research is focused on designing efficient integrated circuits ("chips") that connect digital electronic circuits to the real world. The relentless scaling of semiconductor devices to nanoscale dimensions, a.k.a. Moore's law, has brought a tremendous performance improvement and cost reduction to digital electronics. But the design of interface circuits using nanoscale devices is becoming progressively harder while the performance demands keep increasing. Inventing new circuit techniques is key to keeping electronics, along with all the systems that rely on them, progressing.

These innovations are important enablers to a large variety of applications in which Kinget's group is involved. Novel wireless links using very short pulses to communicate require so little power that they can operate perpetually on energy harvested from the environment, rather than needing batteries. Such highly energy-efficient communication capabilities are key to the realization of EnHANTs (Energy Harvesting Networked Tags), a new type of tags that will enable us to connect and network everyday objects that are part of our daily lives, like wallets, keys, toys, clothing, produce, and even furniture.

But novel integrated circuits reach far beyond communications. For instance, smart power circuits used in combination with new materials and fabrication techniques to make high quality printed capacitors can also be used to convert electrical wall AC power efficiently to DC power for "greener" types of lighting, employing LEDs to replace wasteful incandescent bulbs.

M.S., Katholieke Universiteit Leuven (Belgium), 1990; Ph.D., Katholieke Universiteit Leuven, 1996