2． 項目簡介

(*項目所屬科學技術領域、主要技術內容、授權專利情況、技術經濟指標及應用推廣情況*)
This project focuses on “multi-standard wireless chips” and “multi-physical sensing chips” for functionality extension of next generation smart mobiles. They play a key role in developing an intelligent human-centric society in the years to come.

China consumes ~50% of world electronics, and is the No. 1 importer of ICs in the world with an annual amount of $192 billion (more than the $120 billion in oil). Our State-Key Laboratory of Analog and Mixed-Signal VLSI is one of the two R&D hubs in the country to strategically contribute to the analog IC sectors. Three missions of our key-lab are: 1) developing original intelligent properties (IPs) for a self-sustainable IC ecosystem in China, such that the development will not be handicapped by the abroad license restrictions; 2) fostering high-quality IC R&D and education with other universities, so as to create a bigger momentum for growing the number of IC talents in China, and 3) delivering highly-calibre professionals as the future leaders of the IC industry.

This project was established with an ambition of developing innovative circuits and systems for handheld smart mobiles, while along it, actively promote collaboration with other universities, and with local and mainland students involved. There are two major breakthroughs:

1) Multi-standard Wireless Chips - their challenges can be interpreted as highly-scalable IC solutions, which can flexibly operate at different frequency bands to support the 2G/3G/4G standards. Our works provide variable performances such as channel bandwidth and operating frequency, while saving the cost by minimizing the chip area and number of external components.

2) Multi-Physical-Sensing Chips - Enriching the functionalities of smart mobiles demands a wide variety of physical-sensing units, especially for the healthcare and point-of-care applications that are redefining our living style. Chips for biological/chemical assays such as food quality assurance are invented in this project. The research was selected as the Demo for the visit of President of China (Xi Jinping) to the University of Macau in 2014.

10 U.S. patents have been granted or under review. The knowledge transfer was academically via 1 book, 17 journal publications including 5 in the prestigious IEEE Journal of Solid-State Circuits (JSSC), and 8 papers in the international conferences. One JSSC paper is ranked No. 1 download in Oct. 2015, and 4 papers were presented at the ISSCC in 2015-2016, rendering our group as No. 1 in China and No. 4 in Asia in terms of ISSCC contributions from 2011-2016. Most of the trained students were native from mainland China and Macau.

The project has trained 1 Post-doc, 10 Ph.D., 1 M.Sc. and 2 B.Sc. students. Before the project, the students had no exposure to the world, while after this project they were catapulted to the world-stage of electronics. This is

a precious paradigm of transforming the ill-habitual IC research style in China (e.g., electronics reverse-engineering), to true innovations with solid know-how.

Currently one graduate is applying his intellectual knowledge to advance the cutting-edge products in the world No.1 wireless chipmaker - Qualcomm Inc., using the latest 14-nm CMOS technology. Another one is developing self-powered radios in a startup company (spCHIPs, Inc.), with our project investigator invited as the consultant. Two other graduates are developing advanced cellular transceivers in the Mediatek Inc. In academia, one graduate is now the Macau Fellow in the University of Macau, and another one has been a faculty member in a military institute in Bangladesh. Beyond them, the research team has attracted world-class collaboration. Examples are with the European leading research center – imec (Belgium) and an IoT company (USA). These are testimonies showing the post impact of this project, and the role of our state-key laboratory to enlarge the impact of China to the global IC advancements.

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