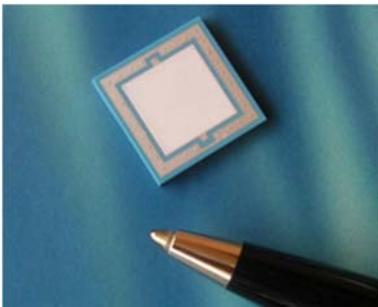


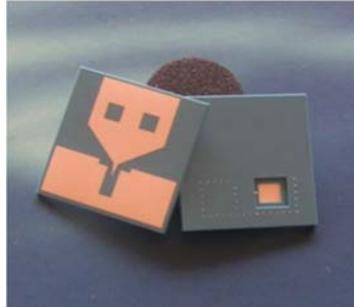
SC06: Antenna-in-Package (AiP) Technology and Applications

Abstract:

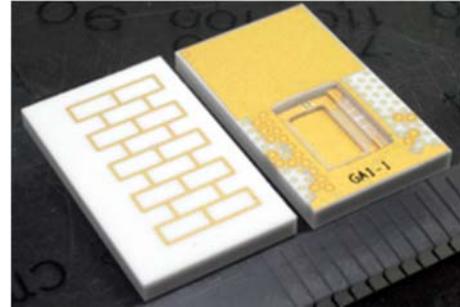
AiP technology well balances performance, size, and cost. Hence, it has been widely adopted by chipmakers for highly integrated radio and radar applications. Recently, scalable large AiPs and multiple small AiPs have been successfully demonstrated for base stations, mobile phones, and networked cars for 5G mobile networks at 28 GHz. Therefore, it is believed that AiP technology will cause fundamental changes in the design of antennas for mobile communications for 5G and beyond as well as Internet-of-Thing devices. This course is aimed at researchers and engineers carrying out work relating to the design of antennas for highly integrated radio and radar systems.



(a) For WIFI Radio



(b) For UWB Radio



(c) For 60-GHz Radio

Recommended prerequisites for attendees:

The course requires a basic knowledge on Basic Antennas and Microwave Engineering.

Learning objectives:

After the course, the participant will be able to know how AiP technology has been developed, as we know it today. Understand the antennas specifically developed and the antennas widely adopted for AiP technology. Get to know materials and processes for high volume manufacturing of AiP. Get to know some fundamental about probe-based antenna measurement setups. Appreciate AiP examples developed for 5G New Radio, 60-GHz Gesture Radars, etc.

Course outline:

- Programme of the course. Please describe the format and content of the short course (200-300 words)*
 - Any remarks, e.g. whether participants need to bring a laptop, etc.
1. An introduction to the trend of the design of radio and radar system on a chip (SoC) or in a package (SiP). This trend calls for novel antenna solutions.
 2. A historical note on the early development of AiP technology. It will be pointed out that researchers in university labs devoted their efforts for Bluetooth radios at 2.4 GHz or other RF applications, while researchers in company labs for 60-GHz radios and other mmWave applications. At 2.4 GHz, a key challenge was how to miniaturize the antenna size, while at 60 GHz, it was how to minimize the interconnect loss between the die and antenna.
 3. A coverage of antennas and packages, materials and processes, testing and characterization for AiP design. For antennas, it will include basic types, specifically developed, and those widely adopted such as microstrip patch, grid array, Yagi-Uda, and magneto-electric dipole. For packages, it will limit to leadless types such as

ball grid array (BGA) and Quad Flat No Lead (QFN). For materials and processes, it will highlight low temperature co-fired ceramic (LTCC), high density interconnect (HDI), and fan-out wafer level packaging (FOWLP). For testing and characterization, it will focus on probe-based measurement setup and testing method.

4. A description of performance improvement techniques of antennas for AiP technology.
5. Real AiP examples for various applications such as 5G New Radio and 60-GHz radio.

Instructor

Yueping Zhang is a full Professor of Electronic Engineering with the School of Electrical and Electronic Engineering at Nanyang Technological University, Singapore, a Distinguished Lecturer of the IEEE Antennas and Propagation Society (IEEE AP-S), and a Fellow of IEEE.

Prof Zhang was a Member of the Field Award Committee of the IEEE AP-S (2015-2017) and an Associate Editor of the IEEE Transactions on Antennas and Propagation (2010-2016).

Prof Zhang has published numerous papers, including two invited papers in the Proceedings of the IEEE and one invited paper in the IEEE Transactions on Antennas and Propagation. He received the IEEE AP-S Sergei A. Schelkunoff Prize Paper Award in 2012.

Prof Zhang holds 7 US patents. He has made pioneering and significant contributions to the development of AiP technology, which has been widely adopted by chipmakers for highly integrated wireless devices. He received the IEEE AP-S John Kraus Antenna Award in 2020.

His current research interests include the development of antenna-on-chip (AoC) technology for very large-scale antenna integration (VLSAI) and characterization of chip-scale propagation channels at terahertz for wireless chip area network (WCAN).



Key bibliography

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