Karlsruhe Institute of Technology

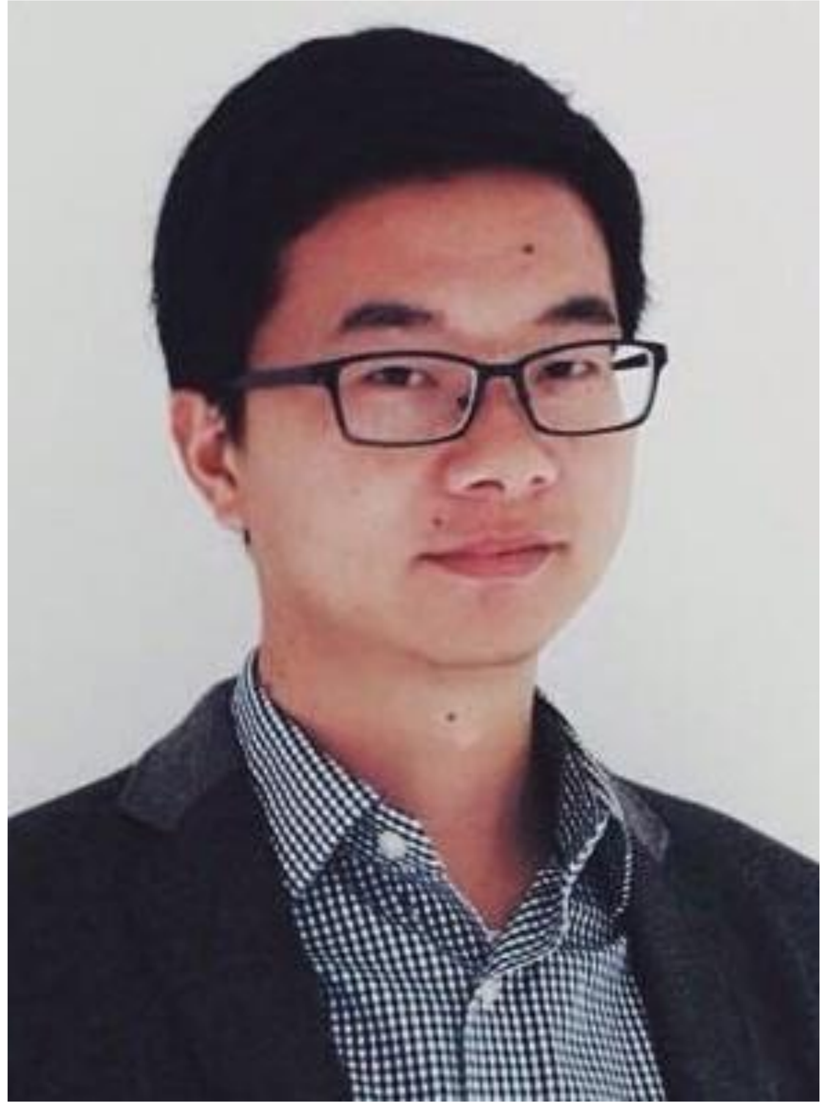
Institute of Radio Frequency Engineering and Electronics

Planar Aperture Antennas - Matching, Radiation and Dispersion

Talk by Dr. Lei Wang, Hamburg University of Technology,
September 19th, 2:00 p.m., Room 3.40, Building 30.10

This presentation will talk about some planar aperture antennas in substrate integrated waveguide (SIW) technology, such as SIW horn antennas & arrays, and SIW leaky-wave antennas. Usually printed circuit boards (PCB) are thin to the operating wavelength. For example, the rate is 0.15 for the thickness of a PCB is 1.524 mm with operating frequency of 30 GHz. This will make the electromagnetic wave very difficult to radiate out, or even radiate with very narrow bandwidth, limiting the antenna efficiency and gain. Thus, we proposed several matching methods to improve it, such as some matching strips directly added after the PCB edge. With the help of the matching strips, the antenna can achieve more than 20% frequency bandwidth. Moreover, for the planar SIW horn antennas, two phase corrected methods are also proposed and embedded inside the horn to adjust the phase distribution at the horn aperture, in order to increase the aperture efficiency. Since the 5th generation (5G) telecommunication is very hot, the proposed SIW horns and their arrays are very easily to be integrated with active and passive components in a single PCB.

SIW leaky-wave antennas are also very popular and very good candidate for high gain antenna, with very simple feeding. However, leaky-wave antennas are always struggling with the frequency-beam-scanning characteristics, which could be good for beam-scanning systems. But if we want to use leaky-wave antennas for high directive point-to-point communication systems, the frequency-beam-scanning will fail for its dispersion. So we proposed a simple and very effective method, loading a dispersive metasurface lens in front of the radiation aperture. As a result, we achieved a more than 20% frequent-bandwidth for a fixed radiation direction. And the radiation direction only varies +-0.5 degree from 33 to 38 GHz with as narrow as 8 degree 3-dB beamwidth.



Lei Wang was born in Nanjing, China. He received the Ph.D. degree in electromagnetic field and microwave technology from the Southeast University, Nanjing China, in March 2015. From September 2014 to September 2016, he was a Swiss Government Excellence Scholarship funded Research Fellow and Postdoc in the Laboratory of Electromagnetics and Antennas (LEMA), Swiss Federal Institute of Technology (EPFL) in Lausanne, Switzerland. From October 2016 to November 2017, he was a Postdoc Research Fellow in Electromagnetic Engineering Laboratory of KTH Royal Institute of Technology in Stockholm, Sweden. From February 2018 to present, he is an Alexander von Humboldt Scholar at Institute of Electromagnetic Theory, Hamburg University of Technology (TUHH) in Hamburg, Germany.
His research includes the antenna theory and application, active electronically scanning arrays (AESAs), integrated antennas and arrays, substrate-integrated waveguide antennas, leaky-wave antennas, horn antennas, metasurfaces, microwave front-ends and systems.

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