SC02: Gap waveguides for mmWave antenna systems and electronic packaging

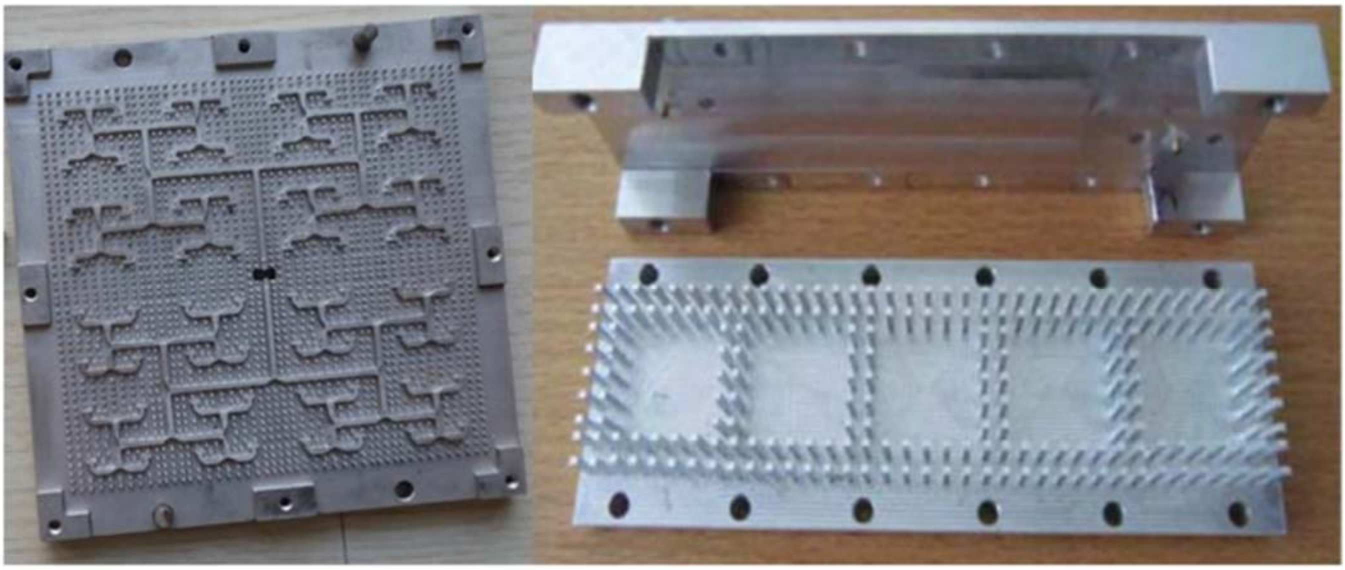
Abstract:

There is an emergent need for higher data rate related to upcoming wireless applications. Given the data rate, capacity and quality of service (QoS) requirements, this can only be possible if the vast unlicensed bandwidth available at mmWave frequencies can be utilized and all the technical hurdles at mmWave frequencies (above 30GHz) are solved in a cost-effective way. In terms of available bandwidth world-wide, flexible transmission rules, 60GHz is a boon from a system perspective. But RF designers have faced enormous challenges in simulation, design, integration, physical realization, packaging and test of the complete systems. The technical challenges are literally orders of magnitude more complex than 2.4GHz or 5GHz Wi-Fi systems of today.

In future, the industrial winners will be the companies that can provide the mmWave hardware at the lowest cost. This requires new waveguide and mmWave packaging technologies that are more cost-effective than normal rectangular waveguide technology, and is more power-efficient (lower losses) than PCB-based microstrip and coplanar waveguides. The gap waveguide technology has this potential.

Also for medium to high mmWave frequencies, antennas need to be located very close to their on-chip RF active components. Thus, the packaging of the complete RF module also plays a very important role for good performance mmWave modules.

The gap waveguide technology presented in this short course is also a potential candidate which can be explored and utilized at mmWave frequency range for antenna and RF subsystem design. This short course will cover an overview of the gap waveguide technology, the parallel-plate stopband design, some mmWave antenna designs based on gap waveguide technology and some RF subsystem design such as filters, packaging of RF electronics etc.



Recommended prerequisites for attendees:

The course requires a basic knowledge on Antenna theory and Microwave Theory

Learning objectives:

The participants be able to understand the basic principles of gap waveguide technology, design rules for the AMC and how different passive microwave components and phased array systems can be designed using gap waveguide technology.

Course outline:

The course outline as follows:

- An overview of soft and hard surface, Hard waveguides.
- Basic principle of Gap waveguide technology, Comparison of losses with other available Microwave technologies such as rectangular waveguide, SIW and microstrip lines etc.
- The importance of the AMC design based on periodic structures, comparison of available stopband using different types of periodic structures.
- High gain planar slot array antenna designs based on different gap waveguide configurations.
- RF sub-system designs such as filters and diplexer designs.
- RF packaging and MMIC-Antenna integration concept based on Gap waveguide.
- Gap waveguide based phased array antenna.

Instructors

Ashraf Uz Zaman is an Associate Professor in the Division of Antenna Systems at Chalmers University of Technology, Sweden. His research interests include millimeter and sub-millimeter technology and systems in general. He has interest in RF passive components such as filters, fixed beam antennas and phased array antennas. He has also keen interest in RF packaging and integration of RF electronics with antennas. His earlier works on Gap waveguide have been considered as pioneering work in that field. He is a member of IEEE AP society. He is the inventor of 5 granted and 3 submitted patents. He is also serving as Associate Editor for IEEE Transactions on Antenna and Propagation.

Eva Rajo-Iglesias is a Professor in the Department of Signal Theory and Communications of the University Carlos III of Madrid, Spain. She has co-authored more than 80 papers in JCR international journals and more than 150 papers in international conferences. Her current research interests include microstrip patch antennas and arrays, metamaterials, artificial surfaces and periodic structures, gap waveguide technology and MIMO systems. She has participated and lead more than 30 research projects with public and private funding.

She has served as an Associate Editor of the IEEE ANTENNAS AND PROPAGATION MAGAZINE (2009-2019) and Associate Editor of the IEEE ANTENNAS AND WIRELESS PROPAGATION LETTERS (2011-2017).

Key Bibliography

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