**Design of planar waveguide arrays and system implementation**

**- Planetary Exploration and B5G Heterogeneous Network –**

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This talk introduces 40 years of personal experience in radio science; diffraction analysis, antenna design and system implementation, together with academic and social activities for B5G.

Unique planar waveguide slot arrays have been developed in Tokyo Institute of Technology. The low loss and high gain characteristics stand out in high frequency. The design started from the single layer waveguide with traveling wave excitation with minimized conductor loss. One and still going application is the radial line slot antenna (RLSA) in 32GHz on board of JAXA Asteroid explorer “Hayabusa 2” which came back to earth on 6 December 2020.

In 5G and beyond, millimeter and even terahertz frequency will be utilized for wider bandwidth. To overcome the bandwidth limitation of traveling wave arrays, we extended them to multiple layers with corporate feed. Next implementation is the proof-of-concept demonstration of the millimeter wave heterogenous network systems named as "Tokyo Tech Wireless Fiber Project"supported by Ministry of Internal Affairs and Communications (MIC), JAPAN. The compact range communication in 60GHz and the direction division duplex system in 40GHz were developed where high gain waveguide planar arrays were fully utilized for big file transfer.

Latest development of arrays of these types would also be mentioned in the light of higher frequency wave technologies in communication networks, which also includes the Beyond 5G R&D Promotion Project issued in 2020 by MIC.