

Dual-band Shared Aperture Antennas and Metasurface Antenna for Ship Mast Integration

Chang-Hyun Lee⁽¹⁾, Sungsik Wang⁽²⁾, Doyoung Jang⁽³⁾, Hyun Kim⁽¹⁾, Youngwan Kim⁽¹⁾, and Hosung Choo⁽³⁾

(1) LIG Nex1 Co., Yongin, Republic of Korea (changhyun.lee@lignex1.com)

(2) Hangyang Cyber University, Seoul, Republic of Korea (kingwss@hycu.ac.kr)

(3) Hongik University, Seoul, Republic of Korea (hschoo@hongik.ac.kr)

Antennas mounted on masts located at high positions on ships require lightweight design to ensure the stability of the ship. One way to reduce the weight of the mast-mounted antennas is to design array antennas that operate in multiple frequency bands to share the common aperture, thereby reducing the overall array antenna size. However, antennas sharing a common aperture often face performance degradation due to coupling between antennas operating in different frequency bands.

This paper introduces dual-band shared aperture antennas designed to address this issue through various methods, such as using mesh structures or applying mutually complementary designs. Fig. 1(left) shows a shared aperture antenna where the upper-layer antenna is designed with a mesh structure, making it transparent in the operational band of the array antenna located in the lower layer (S. S. Wang, H. S. Kim, H. Kim, and H. S. Choo, "Design of a Polarization-Selective EM Transparent Mesh-Type E-Shaped Antenna for Shared-Aperture Radar Applications," *Applied Sciences*, vol. 12, issue 4, Feb. 2022). Fig. 1(right) shows a shared aperture antenna where the upper-layer antenna is designed in a hashmark shape to ensure it does not interfere with the radiation of the lower-layer array antenna, achieving mutual complementarity (D. Y. Jang, S. S. Wang, H. Kim, and H. S. Choo, "Design of a Shared-Aperture Dual-Loop Antenna Using a Mutual Complementary Shape to Improve an Electromagnetic Transparent Characteristics Between S/X-Band Elements," *IEEE Access*, vol. 12, Jan. 2024). In addition, dual-band shared aperture antennas were developed using combinations of heterogeneous or homogeneous antennas. Another approach to reduce the weight of mast-mounted antennas is to use beam-steering antennas based on meta-surfaces. This type of antenna reduces the overall weight of the radar system by reducing the need for transmit/receive modules, which account for a significant portion of the weight of radar system. The measured results of radar system that perform beam steering by controlling phase of the radiated field from each element antenna using meta-surface, as well as more detailed information on dual-band shared aperture antennas, will be introduced in this presentation.

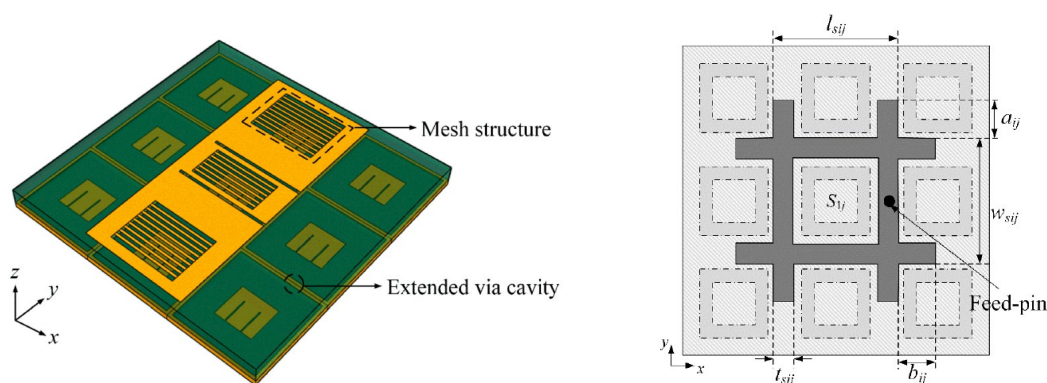


Figure 1. Shared Aperture Antennas Based on Mesh (left) and Mutual Complementary(right) Structures

Acknowledgement : This research has been supported by the Challenging Future Defense Technology Research and Development Program (9127786) of Agency for Defense Development in 2019.