Forum for Electromagnetic Research Methods and Application Technologies (FERMAT)

High-Efficiency Waveguide Antenna with 3-D Metal-Direct-Printing Technique

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Abstract: Two types of 3-D metal-direct-printing technique are proposed to fabricate complicated waveguide antennas. The 3-D printing technique offers the flexibility to fabricate waveguide structures with complex embedded structures with good reliability and high-precision, which in turn helps to avoid the drawbacks from traditional machining methods when the antenna must be built in separate pieces and secured together. Therefore, waveguide antennas can achieve higher efficiency through this printing technique. Two antenna prototypes have been fabricated in different materials through the two 3-D printing techniques, respectively. Experimental results show that antenna efficiency is higher than 80% over a wide operational bandwidth and even exceeding 90% at most frequencies.

Keywords: 3-D printing; Antenna array; Waveguide antenna; High-efficiency antenna.

Reference:

[1] Guan-Long Huang, Shi-Gang Zhou, Tan-Huat Chio, and Tat-Soon Yeo, "High-Efficiency Waveguide Antenna with 3-D Metal-Direct-Printing Technique," IEEE Asia-Pacific Conference on Antennas and Propagation (APCAP 2015), 30 June–3 July, 2015, Bali Island, Indonesia.

[2] Guan-Long Huang, Shi-Gang Zhou, Tan-Huat Chio, and Tat-Soon Yeo, "3-D Metal-Direct-Printed Wideband and High-Efficiency Waveguide-Fed Antenna Array," International Microwave Symposium (IMS2015), 17–22 May 2015, Phoenix, Arizona, US.

[3] Guan-Long Huang, Shi-Gang Zhou, Tan-Huat Chio, and Tat-Soon Yeo, "Application of 3-D Metal-Direct-Printing Technique for Waveguide Antenna Fabrication," IEEE International Symposium on Antennas and Propagation, 19–25 July 2015, Vancouver, British Columbia, Canada.

Dr. Huang received the B.E. degree in Electronic Information Engineering from the Harbin Institute of Technology (HIT), Harbin, China, in 2011, and the Ph.D. degree in Electrical and Computer Engineering from the National University of Singapore (NUS), Singapore, in 2015. From 2011, he joined the Temasek Laboratories at National University of Singapore, Singapore, as a full-time Associate Scientist, and then promoted to Research Scientist. His current research interests include planar antenna array design and implementation, high-power microwave components and 3-D printing technology in microwave application.

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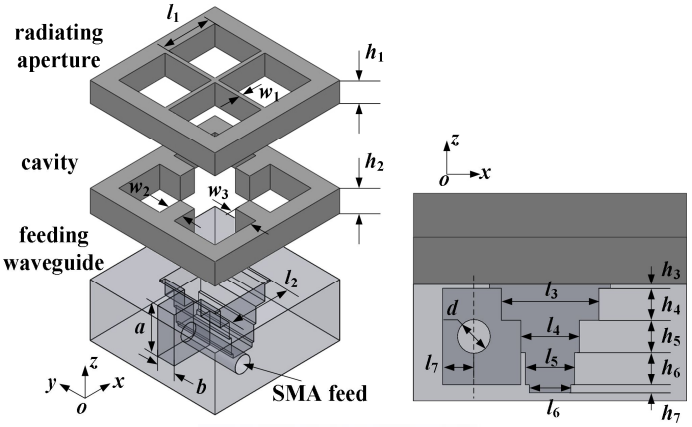
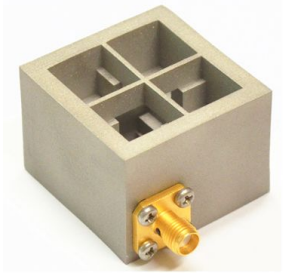
ABSTRACT

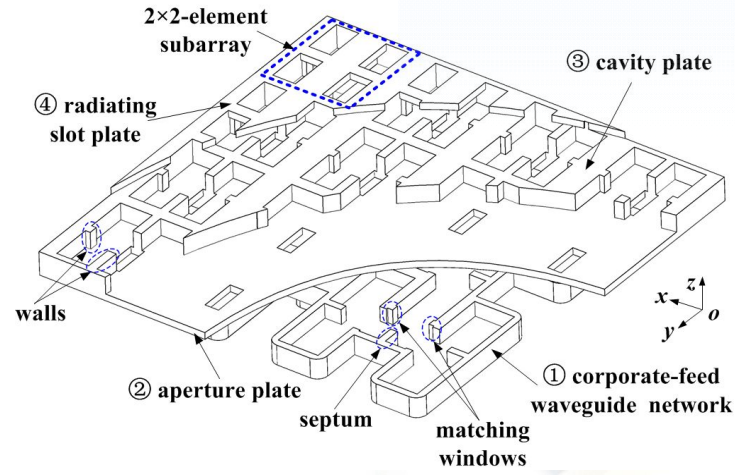
Two types of 3-D metal-direct-printing technique are proposed to fabricate complicated waveguide antennas. The 3-D printing technique offers the flexibility to fabricate waveguide structures with complex embedded structures with good reliability and high-precision, which in turn helps to avoid the drawbacks from traditional machining methods when the antenna must be built in separate pieces and secured together. Therefore, waveguide antennas can achieve higher efficiency through this printing technique. Two antenna prototypes have been fabricated in different materials through the two 3-D printing techniques, respectively. Experimental results show that antenna efficiency is higher than 80% over a wide operational bandwidth and even exceeding 90% at most frequencies.

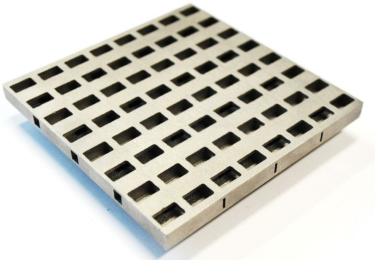
Key words:
3-D printing
Antenna array
Waveguide antenna
High-efficiency

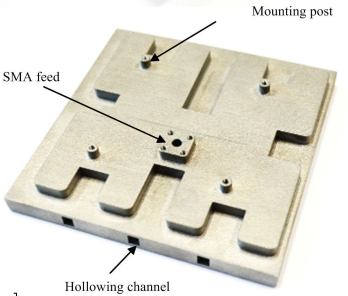
DESIGN & RESULTS

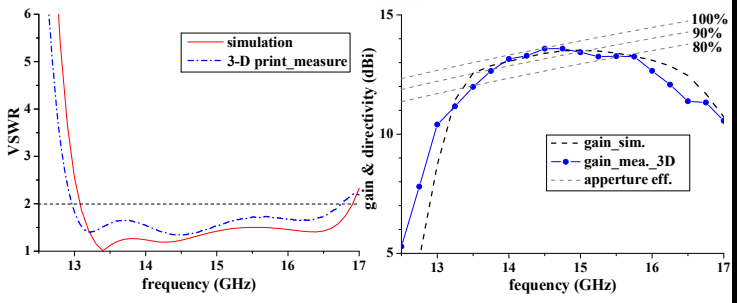


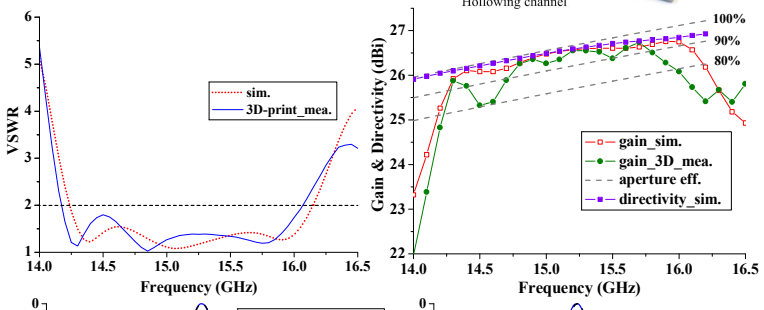


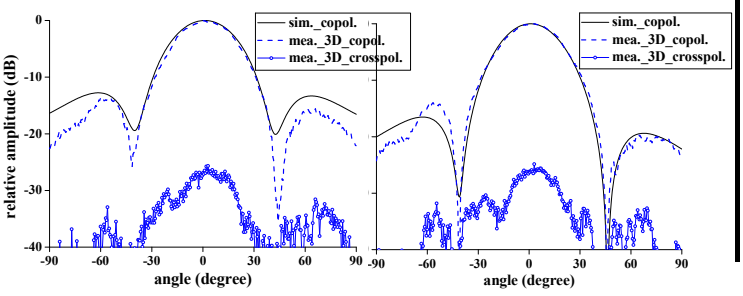


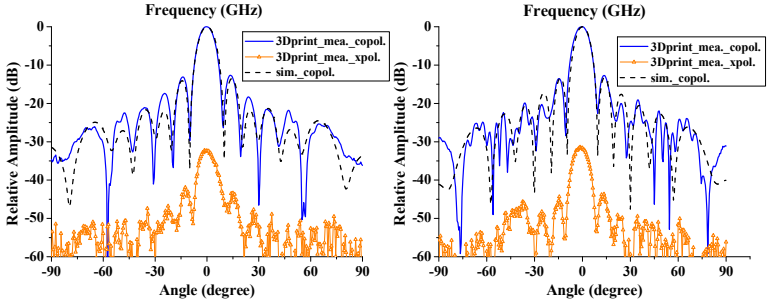












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