

3D Printed Antennas: Enabling Complex Antenna Structures

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3D printing has become an enabling technology for many engineering applications, from mechanical design to biomedical implants and recently for mm-Wave (30-300 GHz) components, including antennas. While 3D printing technology is often cited for its rapid prototyping benefit, the ability to produce complex structures with feature sizes as low as $25\ \mu\text{m}$ opens ample opportunities for manufacturing new as well as classic designs which are either difficult or expensive.

In this work we will present two W-band (75 GHz-110 GHz) antennas which exemplify mechanically challenging structure to manufacture, however are easily created using 3D printing technologies and metalized using a Silver-Copper process developed by our group. The first is a corrugated horn antenna, Fig. 1(a). Corrugations provide improved cross-polarization performance and reduced sidelobe levels compared to standard conical horn antennas. Such corrugations with arbitrary profile, pitch and size are very difficult to produce using traditional methods. We will present the fabrication, simulation and experimental results of a corrugated antenna at W-band and discuss the opportunities and limitations 3D printing offers.

The second antenna we will present is a genetic-designed mesh antenna that uses small conductors in a 3D structure to create a W-band antenna, Fig. 1(b). Genetically designed antennas gained popularity in the past, particularly complex wire bent antennas. These previous designs were realized using a computer-controlled wire-bender to realize the complex shape of the genetically designed antenna. Building on the same concept, one can design a 3D mesh of wires to form more complex antennas. Such 3D mesh, however, are very difficult to realize using traditional machining, wirebending and other means. 3D printing, however provides a solution for such antennas and possibly opens a renewed area of exploration in complex, 3D mesh and non-traditional structures for antennas.

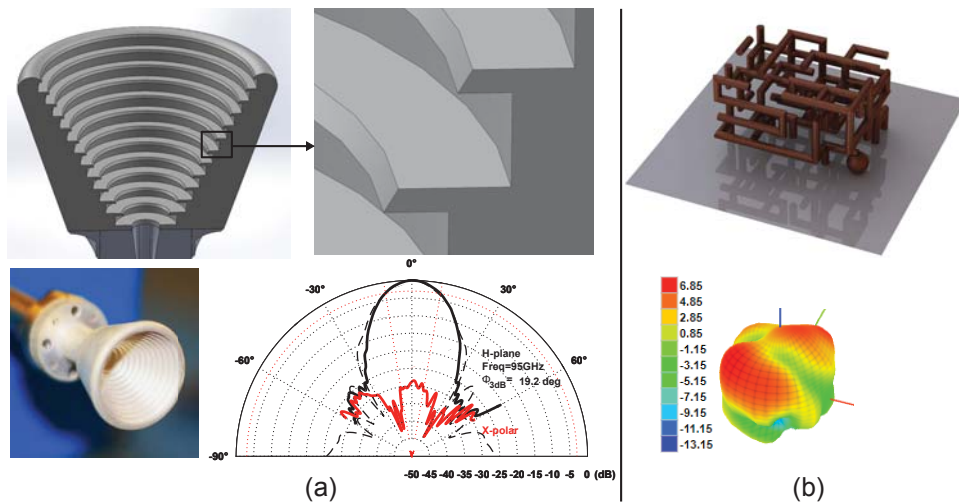


Figure 1: (a) 3D printed corrugated horn antenna; (b) Meshed monopole antenna model and pattern.