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Fully and Partially Metalised 3D Printed FSS Elements

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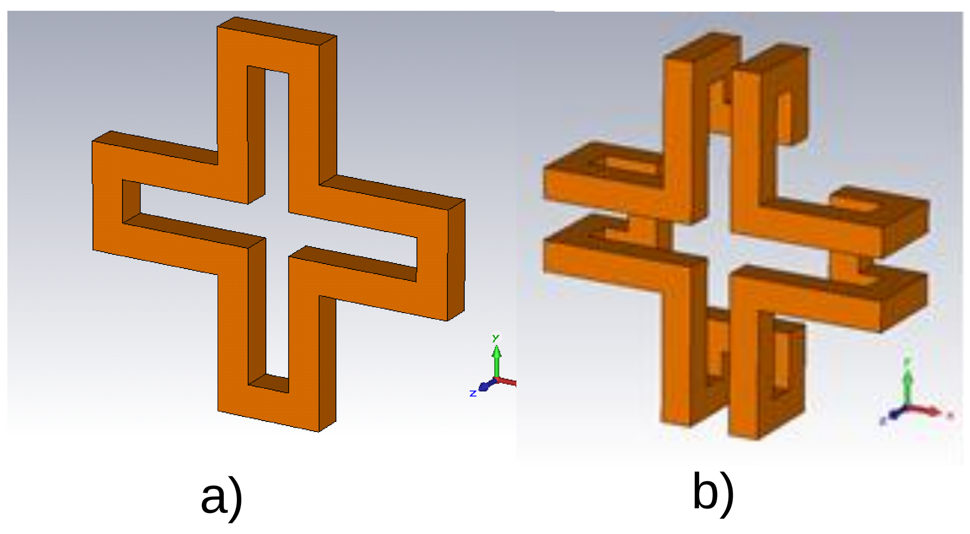
Introduction

Additive manufacturing (AM) or 3D printing (3DP) enables the bottom-up fabrication of objects from a digital model. Complex objects that were difficult or impossible to produce using standard methods can now be manufactured.
There is significant interest in applying 3D printing technology to aerospace applications. It is very probable that future RF components will be integrated into 3D printed parts.
This paper describes the transmission performance of full-metal (volumetric) frequency selective structures and compares them with those of 3D FSS made by partially metallizing the same 3D shapes, thereby controlling induced current paths. 3D printing is used here to fabricate the core of the structures [1], which are based around a new concept of folding FSS elements in three-dimensions [2].

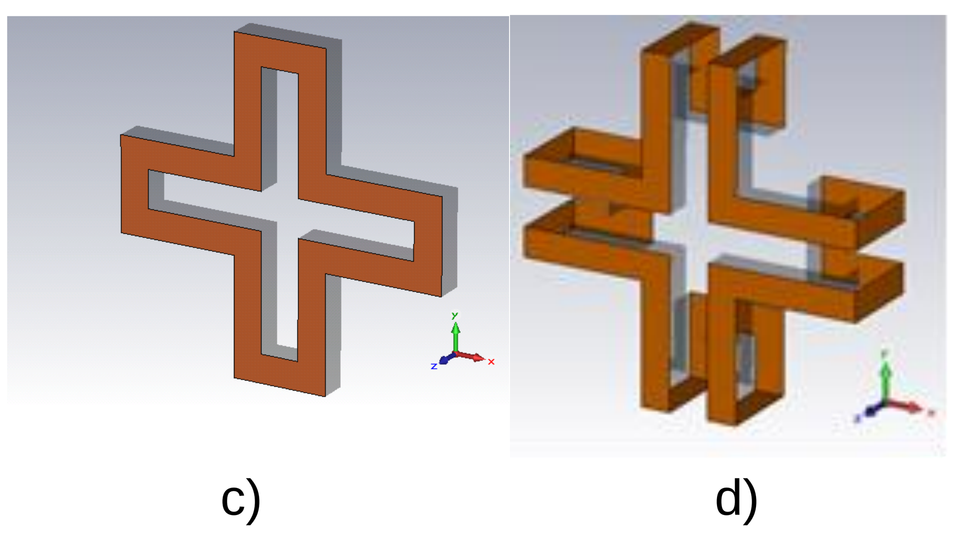
Designs – "Four-legged loaded" loop



Volumetric, entirely metallised

a) original

b) 3D folded

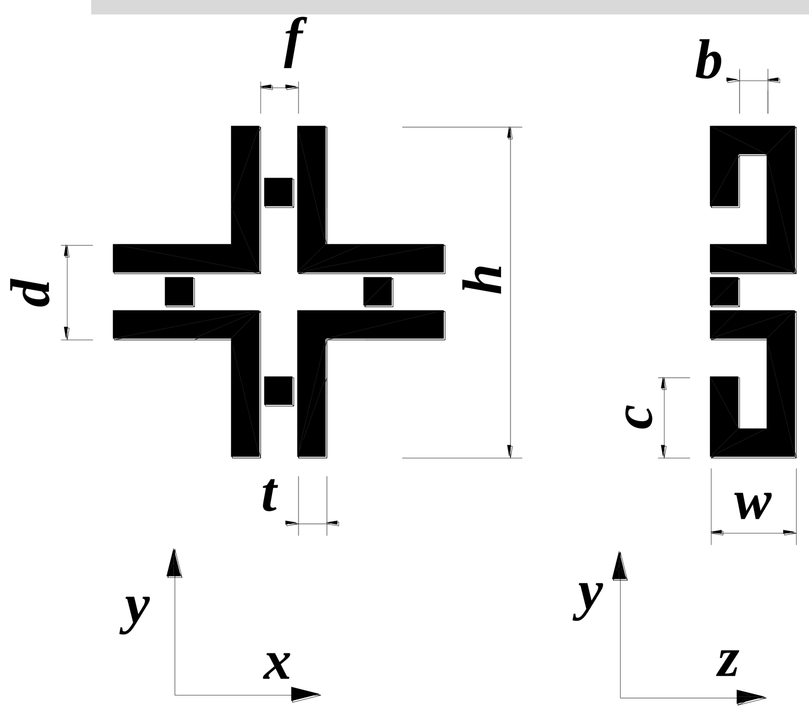


Partially metalised

c) original

d) 3D folded

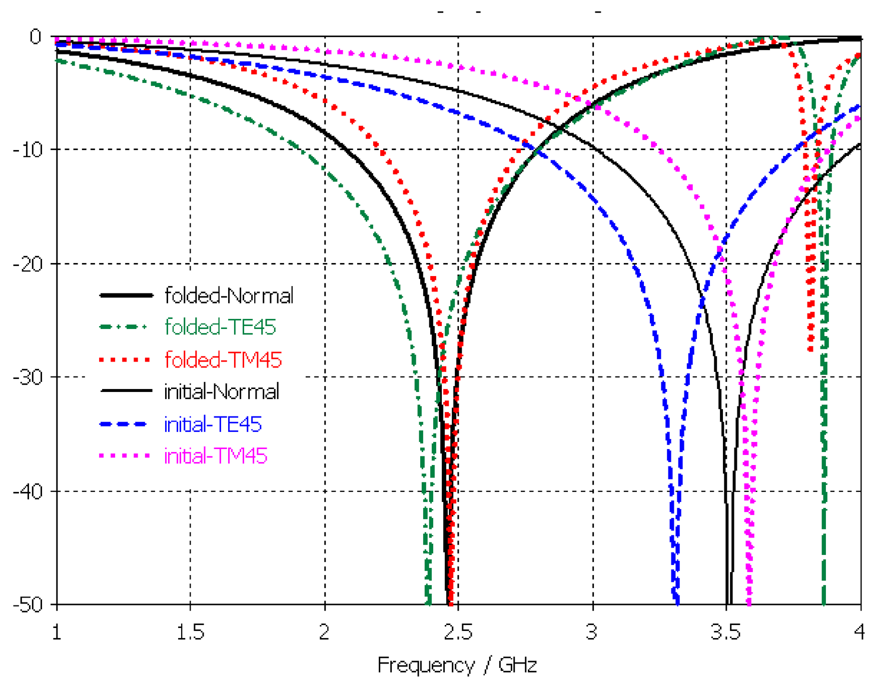
Dimensions



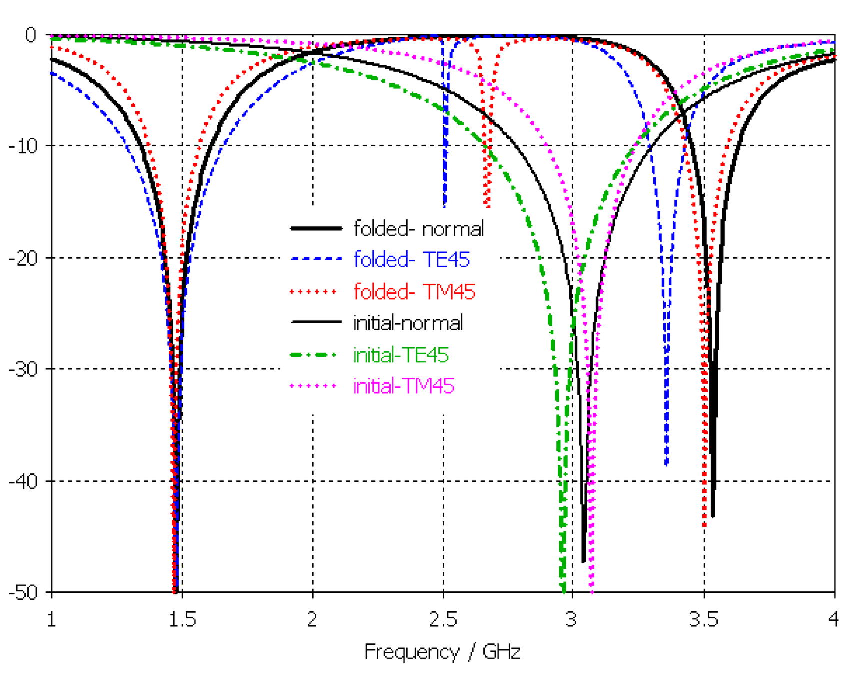
Parameter	*Dimensions (mm)*
h	*35*
w	*9*
d	*10*
f	*4*
b	*3*
c	*8.5*
t	*3*
p	*38*

Simulations

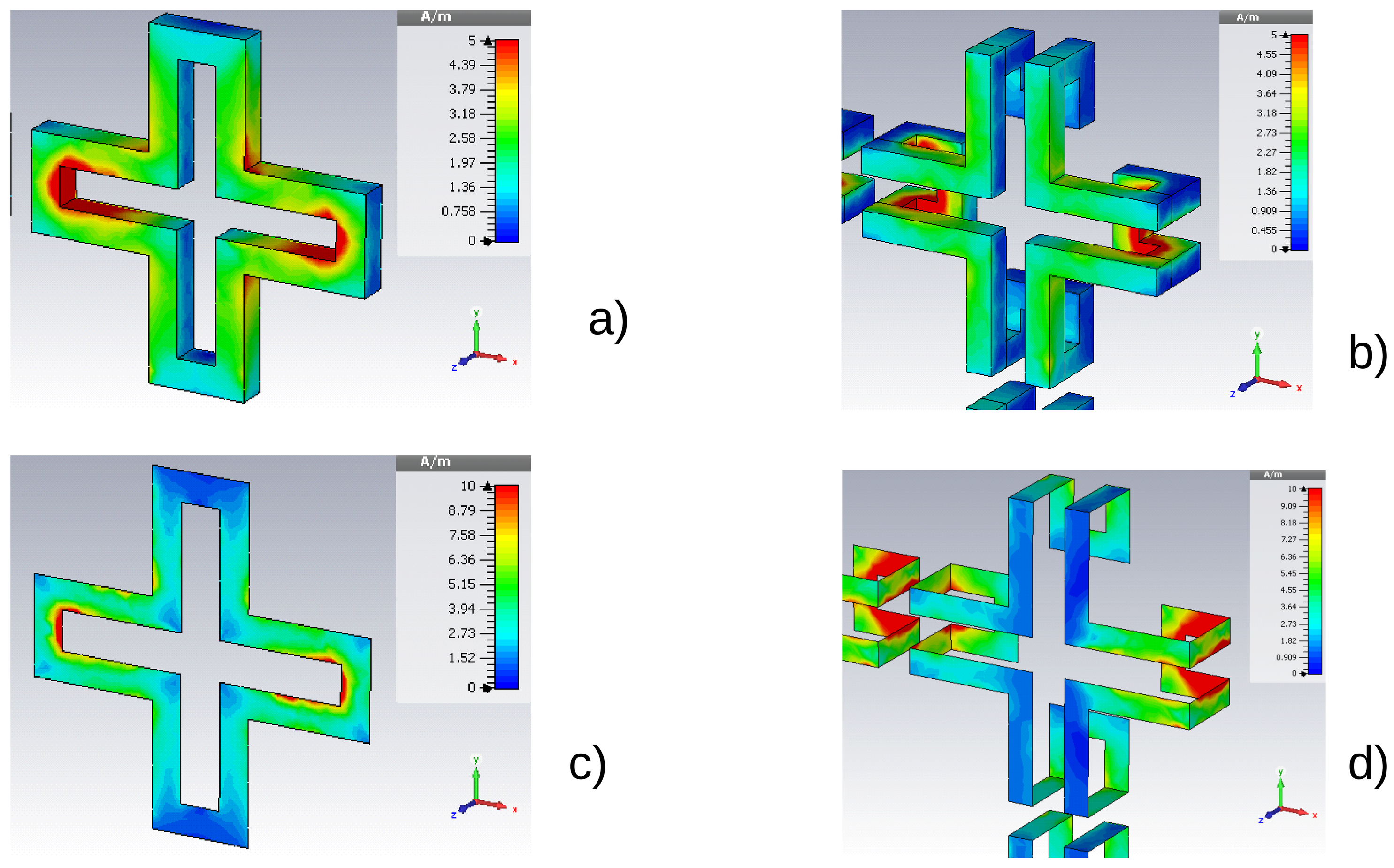
Volumetric, entirely metallised



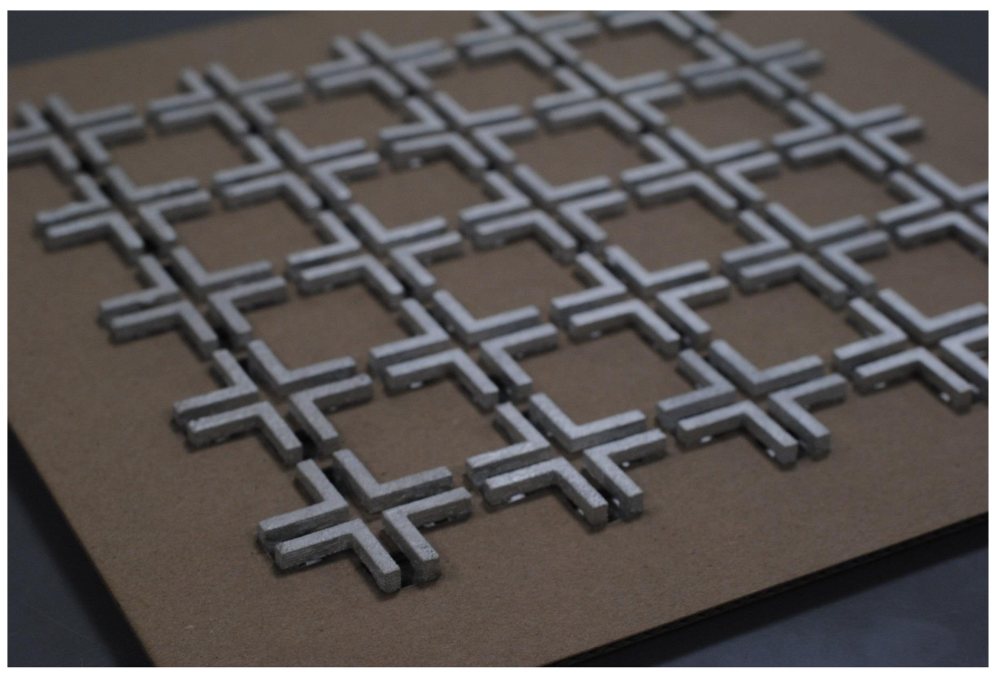
Partially metalised



Surface currents



Fabrication



Volumetric, entirely metallised

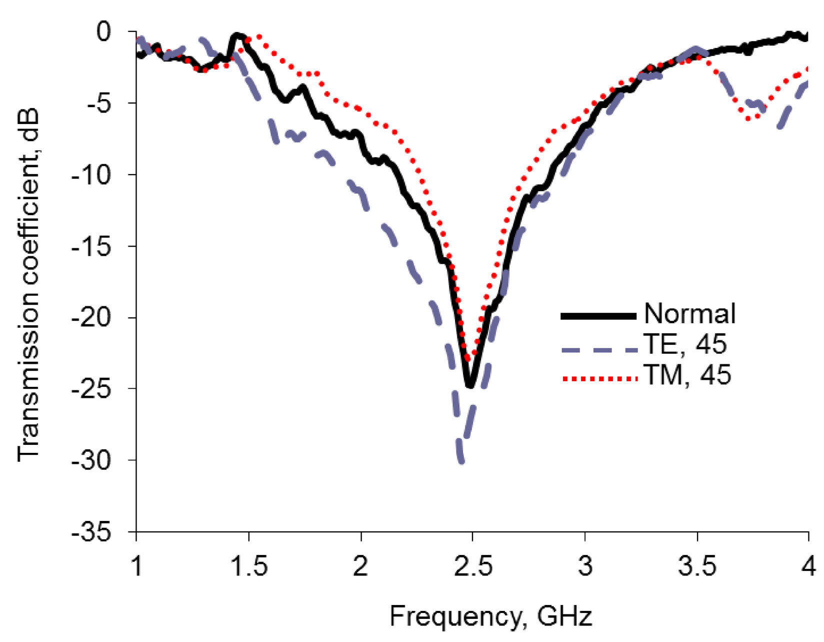
- Elements fabricated with Z650 printer from Zcorp
- Plaster based material
- Elements fully coated using silver conductive paint

Partially metalised

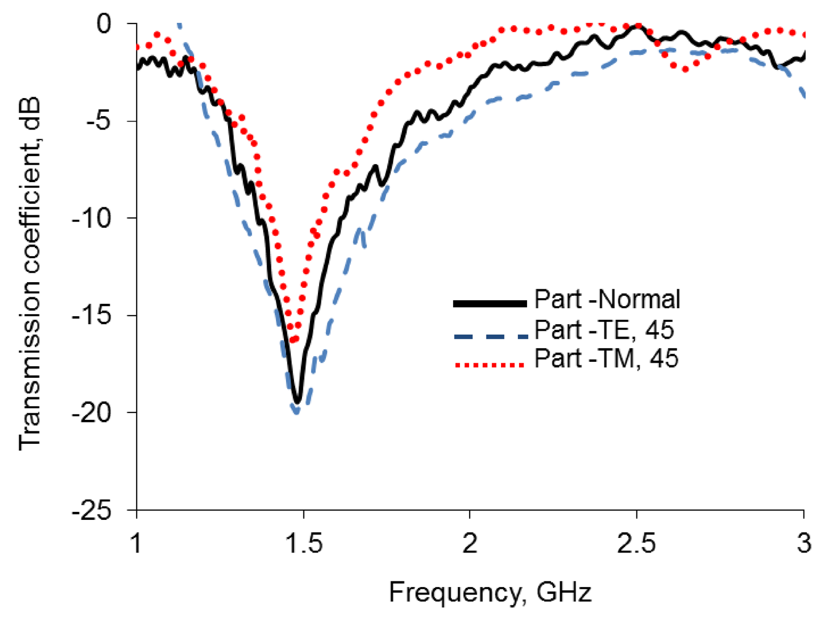
- Inexpensive FDM machine (modified MBOT 3D printer)
- Plastic based material. Polylactic acid (PLA) material
- Elements partially coated using silver conductive paint

Measurements - 3D folded loops

Volumetric, entirely metallised



Partially metalised



Conclusions

This study has demonstrated the possibility of developing complex frequency selective structures using additive manufacturing techniques. Work is progressing on the fabrication of FSS using 3D printing with metal.

Acknowledgements

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References:

[1] B. Sanz-Izquierdo and E.A. Parker, "3D Printing Technique for Fabrication of Frequency Selective Structures for Built Environment", *IET Electron. Letters*, Vol. 49, No. 18, pp. 1117 – 1118, 2013
[2] B. Sanz-Izquierdo and E.A. Parker, "3D Printing of Elements in Frequency Selective Arrays", *IEEE Trans. Antennas Propag*., Vol. 62, No. 12, p.p. 6060 - 6066, Dec. 2014

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