


# Simulation and testing of 3D printed carbon fibre reinforced aeronautical components

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# SIMULATION AND TESTING OF 3D PRINTED CARBON FIBER REINFORCED AERONAUTICAL COMPONENTS

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## ABSTRACT

New manufacturing processes, such as additive manufacturing, allows for going beyond the traditional design approaches. Recent developments in the 3D printing techniques have made it possible to include carbon fibre reinforcements in the printed components increasing their mechanical performances.

The present work aims to explore the possibility to employ these new processes for the manufacturing of aeronautical components. Several experimental tests have been carried out in order to investigate material properties, then holed plates, as well as a real aircraft component, have been considered.

The specimens have been produced by means of the 3D printer Mark Two produced by Markforged and they have been tested under a uni-axial load. The results have been acquired by means of a Q-400 Digital Image Correlation, DIC, system by Dantec Dynamics whose optical features allow to measuring true full field, non-contact and three-dimensional shape, displacements and strains on components and structures made from almost any material.

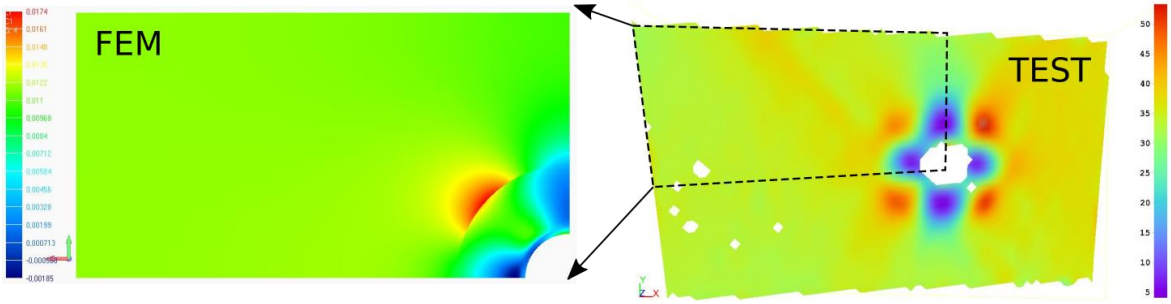


*Figura 1 Comparison between experimental results and FEM simulation, axial strain.*

The use of classical modeling approaches can be inadequate for the analysis of such structures, that is, several numerical models have been considered and their accuracy has been investigated, as shown in Figure 1.

The results demonstrate the potentialities of these new manufacturing techniques and point out the need for an appropriate modeling approach during the design. The possibility to include arbitrary reinforcements in the components can lead to enhanced design solutions.