Design of an additively manufactured structural component inspired by a polymer-metal hybrid McPherson suspension arm

Additive Manufacturing (AM) technologies allow a faster and cheaper manufacturing of parts with unprecedented geometrical complexity [1,2]. The combination of AM with polymer composites, especially if reinforced with continuous fibres, can lead to lightweight structures with fair mechanical properties, which are of great interest for the automotive sector.

In this thesis, an existing structure made of injection moulded short fibre reinforced polymer and metal (see Figure 1) will be redesigned and optimized to be manufactured by additive technologies (fused filament fabrication, FFF). In the reference structure, the metallic insert prevents the complete separation of the part after failure. With AM of composites, this can be replaced by the deposition of continuous fibres with specific paths. Moreover, short fibre composites will be used for low-stress regions, to further reduce the part weight and cost.

Overall, the following activities are expected to be performed:

- Re-design of the reference component, to adapt it to the AM limitations and potentialities
- Optimise the obtained new design, to further enhance the weight reduction capabilities
- Identify and validate a filament deposition strategy to prevent the total separation of the component

Required skills:

- Finite element modelling (Abaqus)
- Knowledge of the mechanical behaviour of composite materials

Expected duration: 6 months
Type: full thesis, with examiner (controrelatore)
Experimental activity: no

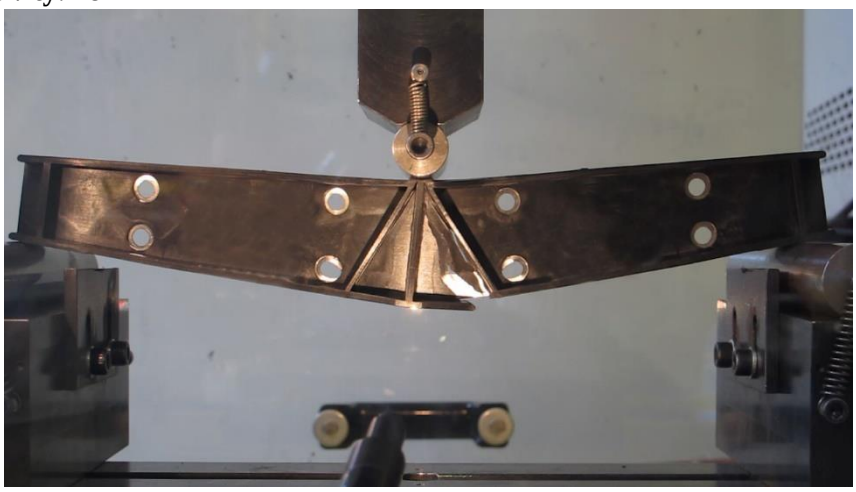

Figure 1: The reference component tested under three-point bending

[1] Parandoush P, Lin D. A review on additive manufacturing of polymer-fiber composites. Compos Struct 2017; 182: 36–53.

[2] Dizon JRC, Espera AH, Chen Q, et al. Mechanical characterization of 3D-printed polymers. Addit Manuf 2018; 20: 44–67.