

An innovative approach of the Design for Additive Manufacturing applied to industrial case studies

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Today, one of the major strengths of the Additive Manufacturing (AM) technologies is recognised to be the freedom of design. The design freedom offered by AM can be exploited for plastics [1] and metal components through several design methodologies such as the one of topology optimization (TO) [2]. These techniques need to be considered and adopted already at the design stage. Using AM, the manufacturing cost is not strongly dependent on the shape complexity [3], hence the design can be tailored on the required component performance. This work presents a general approach for the redesign for Additive Manufacturing. The approach includes the definition of a system of procedures, practices, techniques and rules that must be applied to take full advantage of AM processes. Several industrial case studies are presented in order to demonstrate the power of the proposed approach including both polymer and metal components. Each case study provides a validation of the approach for different targets of the redesign activity developed including the optimisation of assembly operations by reducing the number of components, increasing the stiffness of the component, improving of the air flow and lightening. The activities have been developed within the High performance manufacturing (HPM) project.

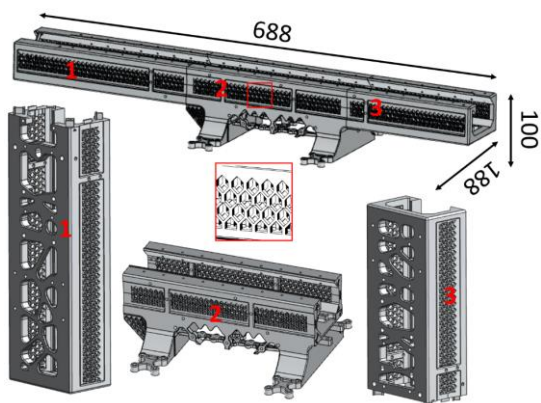


Figure 1. Guideway for precision machine designed for Additive Manufacturing by laser powder bed fusion (L-PBF). Target: Fitting the components in a commercial L-PBF machine and reducing the number of assembly operations and the part weight.

[1] Fantino, E., Chiappone, A., Roppolo, I., Manfredi, D., Bongiovanni, R., Pirri, C. F., & Calignano, F. (2016). 3D printing of conductive complex structures with in situ generation of silver nanoparticles. *Advanced Materials*, 28(19), 3712-3717.

- [2] Salmi, A., Calignano, F., Galati, M., Atzeni, E., An integrated design methodology for components produced by laser powder bed fusion (L-PBF) process. *Virtual and Physical Prototyping*, 13 (3), 2018 p. 1 – 12.
- [3] Atzeni E., Iuliano L., Marchiandi G., Minetola P., Salmi A., Bassoli E., Denti L., Gatto A., “Additive manufacturing as a cost-effective way to produce metal parts”, In: *High Value Manufacturing*, Bartolo P.J. et al., CRC Press (GBR), 2014, pp. 3-8, ISBN: 978-113800137-4.