

## TOPOLOGY OPTIMISATION OF SUPPORTS FOR ADDITIVE MANUFACTURING

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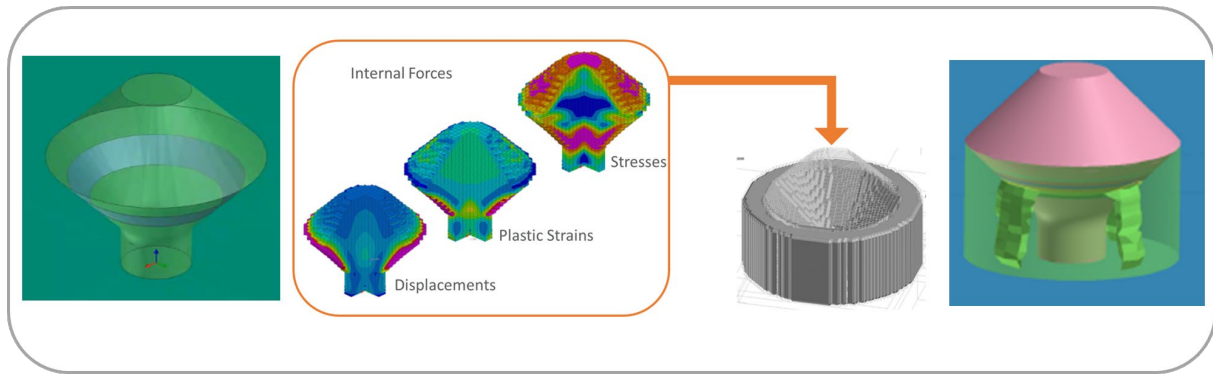
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Expectations of powder bed metal additive manufacturing stakeholders are to improve the performance and robustness by considering the entire metal additive manufacturing value chain – from the development of powders to the manufacture of finished parts. For achieving this objective, several topics have been identified for development. These topics include, among others, perfecting metal powder properties, improving the productivity of additive manufacturing machines by optimizing the material / process pairs and developing new energy sources, and designing parts with optimized technical and economic characteristics. As it enables to create an innovative design, topology optimization has a big role to play in the design part. Furthermore, optimization process is a way to find optimal location and shape of supports needed during additive manufacturing process. These supports satisfy two objectives: 1) to support the component to be manufactured depending on its inclination angle, and, 2) to improve the cooling during the process. These supports are removed from the part at the end of the process. For optimizing these supports, we propose a workflow that combines our Additive Manufacturing<sup>2</sup> and Topology Optimization<sup>1</sup> solution. In the first step, the supports are modelled using special beam elements and a computation for modelling additive manufacturing process is done. The results of this computation, such as the displacement, plastic strains etc. are used as the initial state for the optimization of the supports. We then use our Topological Optimization solution<sup>1</sup> to minimize the volume of supports, ensuring they meet all the Additive Manufacturing constrains. We also ensure that the designed supports are removable. This process is illustrated below:



The goal of this paper / presentation is to present in detail the process that has been put in place, the first results obtained, the industrialization of the proposed approach on a case provided by partners of the project and avenues of improvement for future works.

## References

- [1] TOPAZE – ESI SYSTUS application for Topology Optimization
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