

Advanced simulation to leverage the true Additive Manufacturing potential

Author: Olivier Lietaer, e-Xstream engineering

Additive Manufacturing of polymers is transitioning from rapid prototyping to a true industrial production technique. While it brings valuable opportunities to the industry, such as drastically decreasing the time-to-market of new products or enabling lightweight, multi-material and multi-functional designs, it also comes with a series of challenges for the engineers. The reliability of the mechanical properties of the final part still has some uncertainty and is not fully supported by standard engineering tools. Dimensional accuracy is not always met and cannot be predicted prior to printing.

To support this transition, the engineering workflow which is daily applied for traditional manufacturing processes needs to be replicated and adapted to the additive manufacturing. A holistic simulation approach for additive manufacturing of plastics and composites is proposed, covering material engineering, process simulation and structural engineering of both SLS and FDM. The multiscale material modeling techniques – which are essential to handle the several scales involved in Additive Manufacturing - will be presented and discussed.

The very strong influence of the manufacturing on the material and global component behavior is illustrated in industrial applications and the validity of this integrative approach is demonstrated in several applications, including warpage predictions, the computation of the effective mechanical response of lattices and as-printed part performance simulations (stiffness, strength, ...) as a function of the material and the printing process parameters such as toolpath.