ENCOMPASS strengthens Europe's leading position in metal additive manufacturing

ENCOMPASS is a three-year project that aims to significantly improve the overall productivity of the laser based metal powder bed fusion technology process chain, principally through the creation of an integrated design decision support (IDDS) system.

Additive manufacturing (AM), often referred to as 3D printing, has significant potential to enable novel products with improved performance, improved material efficiency, reduced environmental footprint and reduced production costs. Commercial metal AM machines have been available for many years, and the interest from industry for the adoption of this technology for production of end parts is steadily increasing. However, for these technologies to be widely adopted by industry as a viable production method, process chain productivity needs to be significantly improved. The specific category of metal AM that stands at the heart of the ENCOMPASS project is laser powder bed fusion (L-PBF), where metal powder is fused together to form solid material by means of a laser based energy source.

Whilst metal AM is used for prototyping and has begun to penetrate some smaller markets, it is not yet entirely competitive on a larger scale, especially with respect to production speed and costs. Where metal AM is being used, the current state of the process chain is typified by non-integrated process stages dependent on the knowledge of experts for appropriate decision making. In order to increase the productivity of the process chain and to bring it a significant step further towards industrial manufacturing, a better mastering of all stages of the process chain and their interaction is necessary. Although metal AM is highly flexible, the change from one production lot to the next usually requires operator intervention and time to optimize new build files and processing strategies. The trend towards mass customization of products requires a high degree of digitization as well as tools and systems that are highly autonomous and automated to reduce production time and costs.

The three key overall challenges to industrial exploitation of metal AM can be summarized as: 1. Time and cost for manufacture of components through the whole process chain; 2. Time and cost to get from component design to production 3. Reliability and robustness of the process. To address these challenges, the overall aim of the ENCOMPASS project is to create an integrated design decision support (IDDS) system for the whole L-PBF process chain to flexibly optimize the exploitation of metal AM.

The three key process chain steps tackled in the ENCOMPASS project are: the component design process, the L-PBF build process itself, and the post-build processes (including post-processing and inspection). The integration at digital level enables numerous synergies between these steps and in addition, the steps themselves are being optimized to improve the capability and efficiency of the overall chain. This will enable a significant reduction in time and cost, and an enhanced level of quality for safety critical parts.

To achieve this a consortium of 11 partners, consisting of companies, research centers, and universities involved in AM, has teamed up to deliver the ENCOMPASS project. The 3 year project, which started in October 2016, aims to create a system to flexibly optimize the exploitation of metal AM. Rather than focusing efforts only on increasing the productivity of the L-PBF build process itself, ENCOMPASS considers the process chain holistically which will have a direct positive impact on productivity, which will benefit equipment manufacturers, designers, part-component producers and end-users.

To steer the development and enable demonstration of the performance of the IDDS system, test cases from automotive, aerospace and medical industries have been selected. The industry wide adoption of the IDDS system will enable an uptake of L-PBF in a multitude of other sectors. The successful implementation of the ENCOMPASS project will enable a significant reduction in time from 'design to piece', increase the process chain productivity, and reduce cost of production. The solution is envisage to be under validation mid 2019.

Project partners

The Manufacturing Technology Centre Limited LBG (MTC), Fraunhofer Gesellschaft Zur Foerderung der Angewandten Forschung E.V. (FHG), Renishaw Plc (Renishaw), The University Of Liverpool (ULIV), Rolls-Royce Plc (Rolls-Royce PLC), Industria De Turbo Propulsores S.A. (ITP), Depuy (Ireland) Unlimited (Depuy Ireland), ESI Software Germany Gmbh (ESI Software), Altair Engineering Limited (Altair Eng), European Federation For Welding Joining And Cutting (EWF) and Centro Ricerche Fiat Scpa (CRF).

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