SYNTECS

SUSTAINABLY AND DIGITALLY DRIVEN HIERARCHICAL LASER TEXTURING FOR COMPLEX SURFACES

SYNTECS PRESS RELEASE

SYNTECS Advances Simulation Models for Smarter Surface Texturing

1. Introduction

The SYNTECS project (Sustainably and digitally driven hierarchical laser texturing for complex surfaces), funded under the Horizon Europe programme, continues to deliver impactful results towards sustainable manufacturing transformation. The project is developing an advanced laser surface processing technology designed to replace conventional, energy- and chemical-intensive methods with cleaner, more efficient, and digitally controlled alternatives.

Within the research project, a novel laser surface processing technology is being developed to sustainably replace conventional, energy- and chemical-intensive methods. Our simulation plays a key role in this process: it transfers experimental results – such as processing times from the case studies provided by partners ETL and MTC as well as capacity data and space requirments from the LASEA machine design – into a validated planning framework. This enables us to assess, even before implementing into real systems, how and under what conditions the SYNTECS technology can be effectively and efficiently integrated into existing production environments.

2. Technical highlights

For Simulation Models:

Digital simulation as an enabler for scalable and efficient production

The developed simulation model virtually represents the transition from the conventional process to the new SYNTECS process, providing deep insights into the effects on the overall production system. Based on real production system data from partner ETL, machines, layouts, material flows, and buffer structures are digitally mapped and analysed.

The simulation makes it possible to test various system configurations – such as the number of machines, layout options, or control strategies – to identify the optimal resource setup. The scenario-based analysis, conducted in collaboration with partner MTC, includes experimentally validated best-case tests that reveal how processing times of the new laser technology may evolve in the examined use case and what additional potential can be unlocked.

This allows bottlenecks to be detected early and improvements in throughput times, inventory levels, and resource utilization to be derived in a data-driven manner. In this way, the simulation supports targeted planning and scaling of the new laser technology and contributes significantly to ensuring its industrial viability

For CAD Design & Life Cycle:

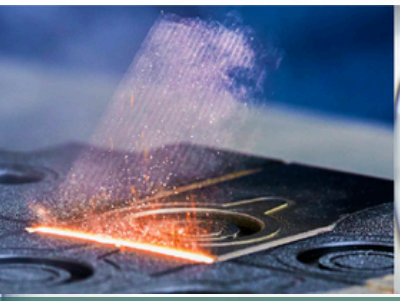
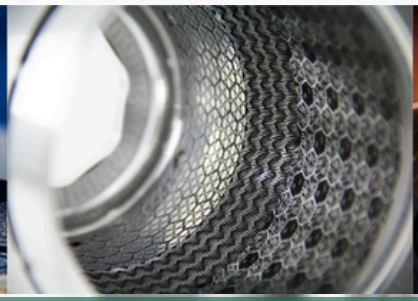
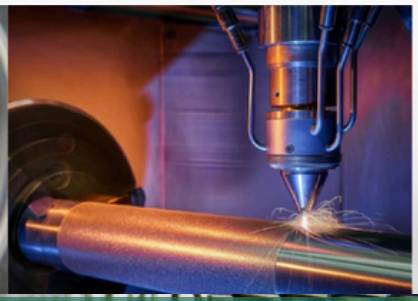
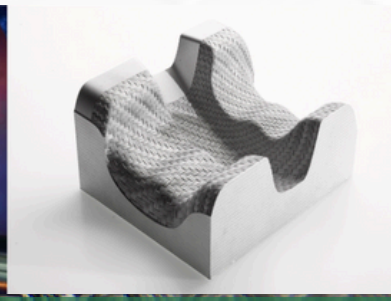
Following expert-led Life Cycle Analysis (LCA), results are imported into the FreeCAD LCA-CAD plugin developed within SYNTECS. This tool bridges engineering design and sustainability by visualising environmental indicators — such as CO_2 footprint, energy consumption, and material use — directly within the design environment.

The plugin allows designers to compare environmental impacts across manufacturing methods at the product design stage. Users can select specific impact categories and product components, with the system generating context-aware visual graphs that illustrate sustainability trade-offs. This empowers engineers to make informed, eco-conscious design decisions early in development, advancing the sustainability-by-design principle and supporting the EU's Green Deal objectives.

3. Impact and Benefits

SYNTECS' simulation and LCA-CAD developments contribute directly to the digitalisation and sustainability pillars of modern manufacturing. By combining predictive simulation, eco-design, and laser precision processing, SYNTECS provides a blueprint for greener and more efficient industrial production.

These tools help companies reduce material and energy consumption, accelerate process validation, and shorten time-to-market for new surface functionalisation solutions. For designers, engineers, and manufacturers, the project's results open new pathways to data-informed decision-making, improved environmental performance, and enhanced industrial competitiveness in line with Europe's twin transition goals.

Partners

www.syntecs-laser.eu

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or European Commission. Neither the European Union nor the European Commission can be held responsible for them.
This project has received partially funding from the European Union's Horizon Europe research and innovation programme under grant agreement No 101091514 and from Innovate UK programme.