Bachelor's Thesis, Term Project, Master's Thesis

Simulation of a Novel Hybrid Aerospace Manufacturing Process

Additive Manufacturing by Material Extrusion– also known as 3D printing – uses thermoplastic polymers to create complex structures layer by layer. Automated Fibre Placement places tapes of continuous fibres according to a given path. The project at the chair will combine these two composite manufacturing technologies into an Advanced Tape Layer Additive Manufacturing (ATLAM) process. By the integration of continuous fibres, it is possible to achieve identical coefficients of thermal expansion as traditional composite parts possess. The ATLAM process will enable aerospace manufacturers to generate composite tools quick and cheap compared to the current state. Specifically, for the current project, landing flaps for an Airbus passenger aircraft shall be manufactured with the produced tools. The long-term goal is to manufacture flying structural parts for the aerospace industry.

The aim of this thesis will be to develop a novel simulation approach of the manufacturing process, accounting for local fibre orientations and thermal behaviour during printing. Modelling the process will ensure part quality before manufacturing the actual part. The simulation will focus on short carbon fibre reinforced thermoplastics with integrated continuous fibres. The simulation model should be based on the path planning of the 3D printing process and aims at predicting the thermal history of the part. Validation of the simulation results will conclude the thesis. Depending on the type and focus of the thesis, the work packages will be adapted.

Research focus of the thesis

- Literature research: Thermal effects influencing the printing process
- Development of the simulation with Abaqus CAE and an existing plug-in
- Validation of the simulation (printing test samples)
- Documentation

Requirements

- Clean and independent way of working
- Interest in FEM and Composite Manufacturing
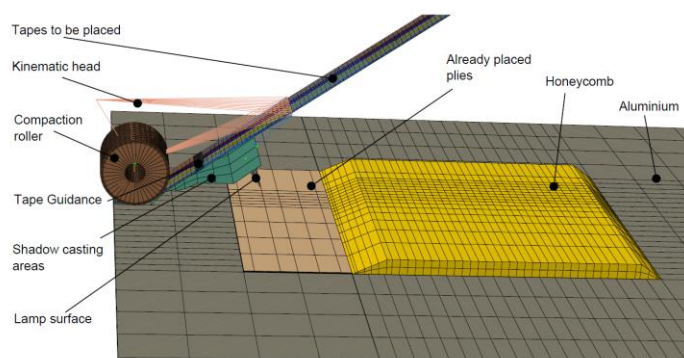- Basic knowledge in Abaqus and subroutines is an advantage

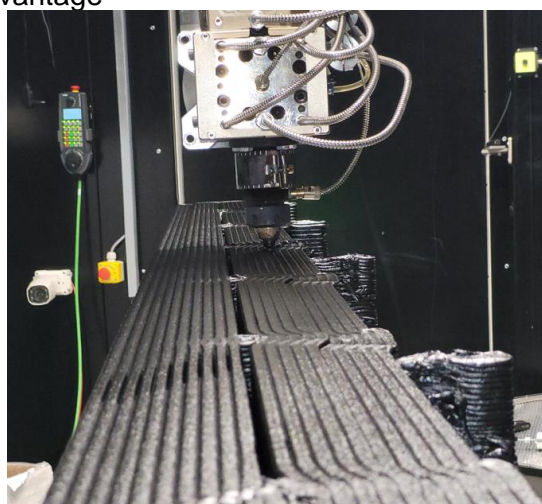Figure 1: AFP Simulation [R.Lichtinger: PhD Thesis at LCC]

Figure 2: Printhead at the LCC facility

Starting date: Now, flexible

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