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FAST TOOL-PATH PLANNING ALGORITHMS FOR ADDITIVE MANUFACTURING

Task

Thanks to its many years of experience in the field of CAM-NC tool path planning for laser material deposition and ablation as well as 3D printing, Fraunhofer ILT is developing software that can be used to generate tool paths from triangular networks. Its goal is to achieve the highest possible speed when processing finely triangulated geometries. The algorithms are to be provided as a library so that application developers can easily integrate them into their own software.

Method

The tool-path planning algorithms are prepared as a library with connections to the programming languages C++ and C#. Additional programming languages can be added. Internal algorithms are optimized for modern multi-core CPUs.

Results

Essential operations of the algorithms are the slicing of triangular meshes in layers and the generation of contour and hatch paths for these layers. This process is accelerated by parallelization on multi-core CPUs. For a test geometry with 350,000 triangles, the tool-path planning with commercial software takes between 6 and 40 seconds for a uniform layer thickness. With the newly developed algorithms, the tool paths are generated on a processor core in 6 seconds and on 16 processor cores with activated multi-core calculation in just 0.6 seconds.

Applications

For example, the program library can be used as a fast and flexible solution for tool-path planning for laser powder bed fusion (LPBF). A simple interface facilitates access for integration into user software. In close cooperation with the process developers, Fraunhofer ILT will add algorithms for the generation of supports tailored to LPBF in the future.

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3 *Generated tool paths for example geometry, contour tracks (blue) and hatching tracks (red).*

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