

# Development of Computer Aided Design / Computer Aided Manufacturing (CAD/CAM) software for CNC Hybrid metal 3D Printing & Milling machines

Master thesis proposal 2019-2020, AVRГ, MECH VUB

3D printing of metal components brings a very large designer freedom into the production of metallic parts. When combined with traditional subtractive (milling, turning) techniques a high-performance hybrid machining platform allows to manufacture metallic parts with large design freedom, but also with functional features (geometric tolerances) and good surface finishes.



Figure 1: Laser cladding of metal component. (1)

The AVRГ research group from the Mechanical Engineering department at the Vrije Universiteit Brussel is involved for over 5 years in the monitoring and control of the melt pool of Direct Laser Metal Deposition (LMD) 3D printing of metal components (Fig. 1). Since 2017 the group has been designing and building their own Hybrid laser metal 3D printing machine, combining LMD additive & High-speed milling techniques into one machine platform: MiCLAD.

The aim of this master thesis is twofold. First an extensive market study of existing CAD/CAM software packages (Fig. 2) has to be performed by the student. The goal of this literature/market study is to identify the weaknesses of such commercial or research softwares when combining both additive (3D printing) with subtractive (milling) processes in a hybrid, iterative, process.

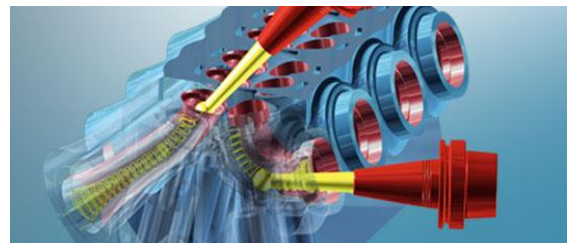


Figure 2: CAM of Engine manifold. (2)

Secondly, based on these outcome, the student is expected to write some software modules (Matlab, Python, C++, ...) in order to provide the integration of specific features in the parts being used for current research in Structural Health Monitoring of aerospace components based on the integration of fine capillaries in mechanical components.

Software for the simulation of the own developed algorithms in a simulated version of the MiCLAD CNC machine build by the VUB is available (Fig. 3). After successful validation of these test, actual test cuts of components can be made on the machine.

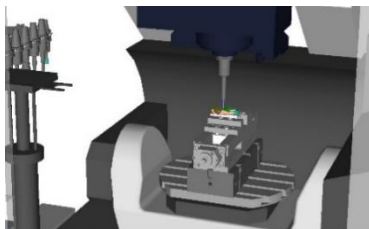


Figure 3: Simulation of CNC CAM programs.

The student should have a global interest in the (computer aided) design of mechanical components and good software development skills. This master thesis is an ideal starting point for people interested in continuing with a PhD in software development for 3D printing machines of high quality metal components.

**Contact:** Julien Ertveldt  
VUB Dept. MECH  
Office Zw 120  
Pleinlaan 2  
1050 Brussels  
[Julien.ertveldt@vub.be](mailto:Julien.ertveldt@vub.be)  
[www.avrg.be](http://www.avrg.be)



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