SLM SOLUTIONS

Case Report

Hydraulic valve block for High-Performance

NURMI

VTT

3D-printing of light-weight components

Additive manufacturing for heavy-duty applications

VTT

VTT Technical Research Centre of Finland Ltd. is the largest multidisciplinary research organisation in Northern Europe. It provides high-end technology solutions and innovation services. VTT is a non-profit research organisation. VTT was founded in 1942 for scientific and public utility. VTT has its headquarters in Otaniemi. VTT is originally an abbreviation of Finnish words „Valtion Teknillinen Tutkimuskeskus“ (State Technical Research Center).

VTT offers R&D services to a number of industry sectors using these technologies. Through its international scientific and technology network, VTT aims to produce information, upgrade technology knowledge, create business intelligence and value added to its stakeholders. VTT has 2,834 employees, of which 81% have a university degree and 26% a postgraduate degree. There are 1,510 customers, of which 865 are domestic companies, 385 foreign companies and 220 public bodies. VTT has a patent portfolio of over 1,200 patents and 605 peer-reviewed scientific articles.

3D printing of high-performance, cost-effective, light-weight components

Additive manufacturing (AM) is opening up new business opportunities by freeing design from the restrictions of traditional manufacturing processes, enabling customization, and speeding up product time-to-market. Together, VTT Technical Research Centre of Finland Ltd and Nurmi Cylinders Oy have developed a cost-efficient, 3D-printed, reliable hydraulic valve block that is 66% lighter than the original part.

3D printing, also called additive manufacturing or AM technology, enables the production of objects of nearly any shape without the limitations associated with traditional manufacturing methods. Combined with advanced design and optimizated techniques, the potential cost-savings of AM extends to the design phase where simulation can reduce the number of necessary design iterations. This technology also enables small, one-off production runs, which remove the additional costs typically associated with customization.

A new hydraulic valve block has been developed by VTT and Nurmi Cylinders, with a design that has been optimized to take full advantage

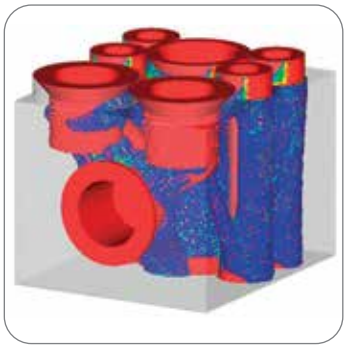


Figure 1

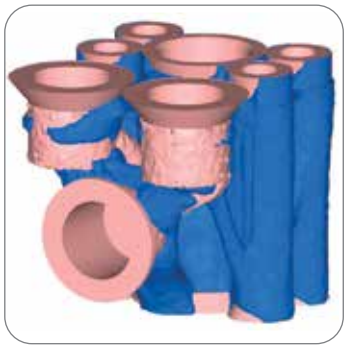


Figure 2

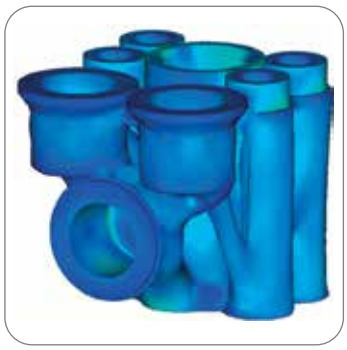


Figure 3

Figure 4

of the benefits of 3D printing. The result is a product that is 66% smaller than the original model design space and 76% reduction compared with a traditionally manufactured valve block – leading to savings in weight, space and material. The valve block, which is used to control hydraulic cylinders that move under loads applied via the hydraulic fluid, can be found in cranes for example. Traditionally, the internal channels of the valve block are created with straight, circular drillings in a solid block of material. Additionally, several auxiliary drillings are needed, which are plugged and create the potential for leakages. With AM, the internal channels of the valve block can be optimized to a better flow and space savings, while the potential for leakage is removed because auxiliary drillings are no longer necessary.

„Using a laser for metal 3D printing is fairly new in Finland. Metal powder is spread one layer at a time and laser-melted at the desired areas. Unique, new materials are under development which will lead to new features and designs not yet commercially available. We have analysed the manufacturing costs and identified cost savings. In the future, this technique will give free hands for a designer, because manufacturing is not limiting geometries anymore," says Senior Scientist Petri Laakso of VTT.

Together with the private sector, VTT engaged in a two-year project in November 2014 aiming to create new business within Finland with the use of AM technology. The overall project consists of the companies' own projects and a research project by VTT, in which the companies are also participating. Tekes, the participating companies and VTT are providing the budgeted funding of three million euros. The project is part of VTT's For Industry spearhead programme and its SME project startups.

Figure 1: Topology optimization result (element density color contour plot)
Figure 2: Interpretation and remesh of topology optimization result
Figure 3: Analysis of smoothed optimization design
Figure 4: Final smooth CAD file, ready for printing

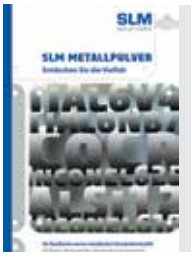
VTT

Hydraulic valve block for High-Performance

- New potential from metal based additive manufacturing technology
- Hydraulic Valve block is build up in one process by SLM® systems
- 66% smaller than the original design
- Savings in weight, space and material
- Potential for leakage is removed because innovative design is used

SLM®125HL

Please request our separate brochure.



Metal Powders

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