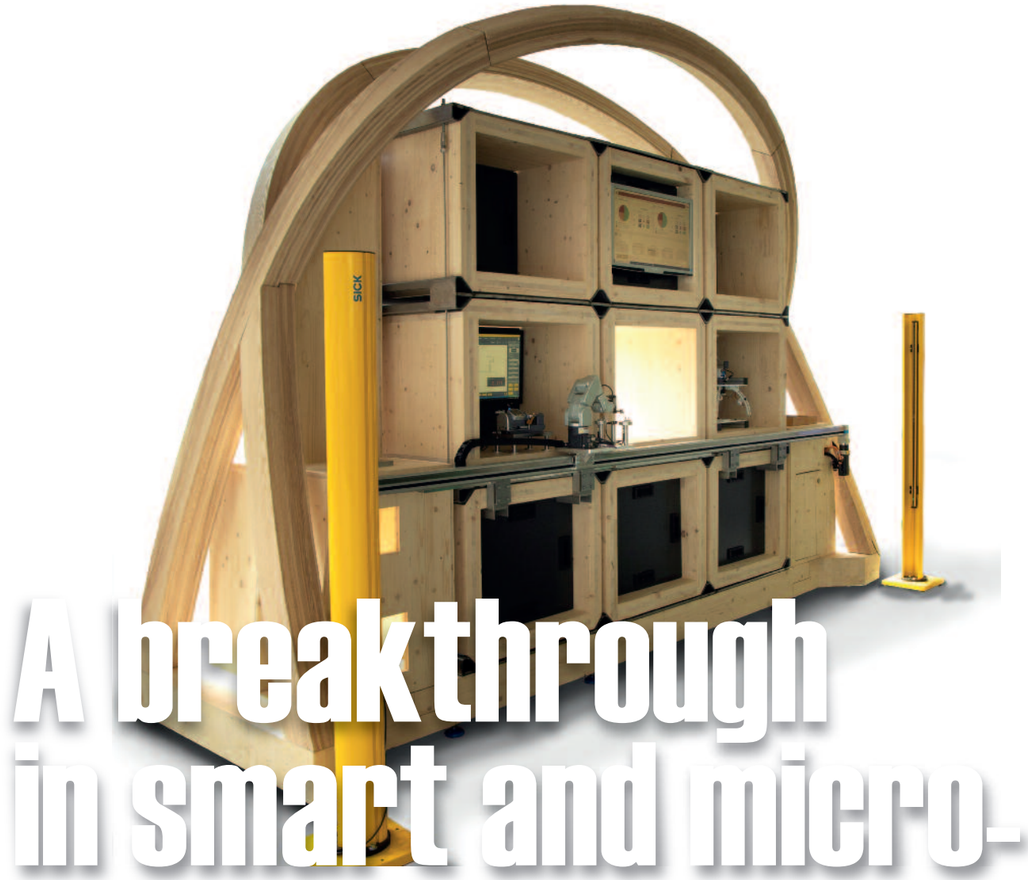


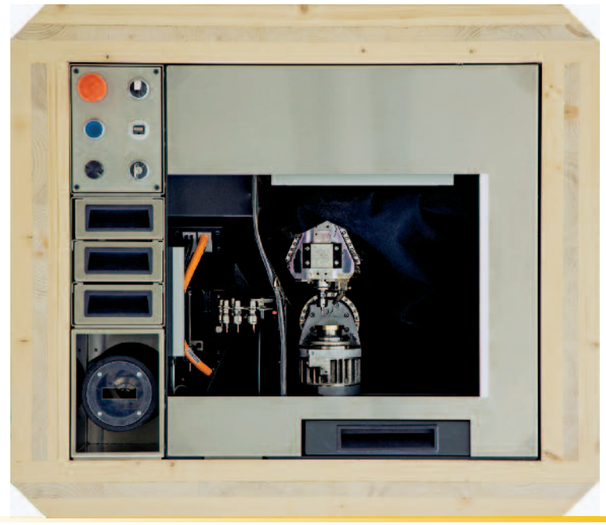
1.

A breakthrough in smart and micro-manufacturing

The Haute Ecole Arc Ingénierie sits in the heart of Switzerland's most industrialised region. It leads applied research projects and trains engineers destined to perpetuate Swiss Made excellence. To stimulate the Swiss microtechnology industry and position it at the forefront of the digital transition and the new production methods, HE-Arc Ingénierie set up the MicroLean Lab.

1. The microfactory that is being developed through the MicroLean Lab.

2. Micro^5, the 5-axis machine developed by the Haute Ecole Arc Ingénierie, is adapted in order to fit into the microfactory, as one of the specific functional units.



2.

The arrival of the «Micro^5» in 2016 kick-started a revolution in terms of microtechnology production methods. Developed by engineers at the Haute Ecole Arc (HE-Arc), this technological gem consumes ten times less energy and takes up five times less floor area than conventional 5-axes milling machines.

«The purpose of this new industrial vision is to achieve the aims of Industry 4.0, from personalising products to reshoring production tools through the use of digital technology.»

Philippe Grize, Head of the Haute Ecole Arc Ingénierie

With that micromachine now being manufactured and sold by several Swiss businesses, HE-Arc Ingénierie is taking things to the next level: the microfactory. The microfactory is not just a single milling machine, but the entire production system used by the microengineering industry that will henceforth be designed to be exactly the right size for the components and finished products it manufactures.

By scaling the factory more efficiently, both the energy consumption and the footprint will be lower. In addition, microfactories will allow manufacturing to take place closer to the end user, thereby reducing the need for energy-intensive, global logistics with risky supply chains.

A reconfigurable, connected, autonomous microfactory

To achieve this, a wide range of miniature «technology bricks» need to be designed. Each will perform a specific operation, such as milling, bar turning, polishing, laser cutting, measuring, cleaning, and even 3D printing.

A cyber-physical system will provide an agile, autonomous means of moving parts and tools from one machine to another, from the stock of raw materials to the finished product. Each piece of miniaturised milling, assembly, handling and control equipment needs to be able to communicate with the others, in other words it must use standardised communication protocols that allow data to be collected and used effectively.

With its «plug and play» technology bricks, the microfactory will be easy to reconfigure so that custom products can be manufactured at a similar cost to mass-produced items. This will enable the microtechnology industry to respond to the growing demand for personalised products, whether they be luxury items or medical implants. More generally, the industry will be able to switch to production processes that suit a demand-based economy.

Thanks to interconnected sensors and embedded artificial intelligence, the microfactory will also be capable of perceiving what it is doing and adapting its work in real time in order to get the products it makes right the first time.

Of course, there are no shortage of technological challenges involved. And the various industrial and academic partners who have joined the MicroLean Lab's community of interest will require all of their know-how to overcome them. But they are capable of living up to the expectations of a society that is increasingly aware of the environmental and socioeconomic impact of its actions.

www.microleanlab.ch
www.he-arc.ch/ingenierie