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A major challenge facing the European manufacturing sector is how to reduce shaking and vibration in production lines so consumers get better quality end-products. But it is complex and costly to adapt operations already in place.

An EU-funded project has developed a smart “plug-and-produce” solution for industry to transform existing machinery into more accurate tools for today’s modern production lines.

The assembly line developed by the Ford motor company is exactly 100 years old, but a century on technological advances are revolutionising the factory floor once more. These include novel materials, sophisticated autonomous machines, and adaptive, customisable equipment and tools.

A major challenge facing the European factory of the future is how to adapt existing machinery and tools to meet the increasing demands on the production line for more precision.

The EU-funded project HARCO has provided a solution by showing how “plug-and-produce” modules can reduce vibration and shaking, helping to make production line machines more precise.

Plug-and-produce technology borrows from the popular “plug-and-play” computing concept, where a user literally only needs to ‘plug’ in an additional device, such as a USB stick, to a PC and it will start working or ‘play’. Being able to ‘add on’ software or hardware as needed to improve manufacturing quality or output is a major step in industrial production processes which are typically more rigid and require costly expertise to adjust even the smallest parameter.

“We expect HARCO to have a significant impact on the machine tools and production equipment industry, as well as European manufacturing in general,” says project coordinator Gian Mauro Maneia, from the Centro Studi Industriali in Cologno Monzese in Italy. “Our plug-and-produce smart add-ons will increase productivity, improve the quality of the machined pieces and enhance energy efficiency. This will raise the competitiveness and sustainability of European industry.”

Building blocks
The challenge for HARCO’s team was to develop extremely stiff, light and well-damped structures that can be integrated into electromechanical and electronic devices, measuring systems, sensors and actuators. Vibration damping is essentially reducing the amount of vibration in a system.

They worked on creating innovative and scalable solutions through a combination of lower level units that act as a functional brick or building block which can then be integrated into machine parts as ‘plug-and-produce’ components.

Functional bricks are smart actuators and sensors which perform a range of actions, including regulating damping and stiffness, conducting measurements, and controlling temperature and motion.

These smart components – both hardware and software – can then be fitted together to create adaptable modules that can be plugged into machines as versatile and dynamic add-ons.

HARCO built several models to demonstrate the huge potential of these so-called “adaptronic modules”. One of the more advanced was a milling machine, which was equipped with a number of modules, including one for spindle vibration control, and a micro-positioning table. Another demonstration used a structural monitoring module, which can be used to adjust machine tools as temperatures change.

The project also developed special tools which combine the flexibility and function of conventional production-line robots with higher levels of accuracy and speed. These so-called “kinematics machines” were built using smart, light-weight components, such as struts and joints that adapt to the conditions on the factory floor.

“Adaptive structures will be at the frontier of knowledge and will revolutionise machine tool and manufacturing machinery design and construction in the 21st century,” says Maneia.

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Project:
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Project Acronym:
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