

LCM
K2-Center for
Symbiotic Mechatronics

Programme: COMET – Competence
Centers for Excellent Technologies

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Engineering of Complex Systems,
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DIGITAL HYDRAULIC DRIVE UNIT - SYMBIOTICALLY INTEGRATED INTO A MANUFACTURING PLANT

IMPROVED RELIABILITY WITH POSITIVE SIDE EFFECTS.

To produce composite based friction products, heat-resistant carbon-based friction linings are pressed on steel discs under high pressure.

This process is divided into a fast motion and a pressure holding mode which was originally realized by a motor-pump-valve unit. A certain hydraulic valve showed dramatically signs of wear. That's why it had to be exchanged quite often. These frequent exchanges resulted in high component costs and long system down times.

A cooperation between Miba Frictec GmbH and Linz Center of Mechatronics GmbH managed to improve the system by a hydraulic addon, the "Digital Pressure Control Unit" short DPCU, in terms of robustness and efficiency and made it fit for future. More generally, this addon complements symbiotically – like the paradigm of the COMET K2 Center "Symbiotic

Mechatronics" – the main drive and allows optimal operation points in both operating conditions.



Picture of the hydraulic block of the DPCU
(<https://www.lcm.at/hydraulics-topics/#digitalhydraulik>)

The DPCU is currently being used by Miba Frictec GmbH. It improves the system durability as well as the control performance in the operational process. A positive side effect is an efficiency improvement up to 80 percent due to the use of non-leaking seat valves which reduce leakage losses dramatically. Noise is much less than before which improves the working

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atmosphere in the production hall. The hydraulic add-on is based on a technology called “digital hydraulics”. It was developed as a part of the COMET K2 Center by Linz Center of Mechatronics GmbH.

Scientific challenges

The base principle of digital hydraulics is inspired by electrical circuits where analogue controls are replaced more and more by digital ones. Three challenges arise for the hydraulic case. Needed are (I) very fast switching hydraulic valves, (II) an according electronic control circuit which drives the valve properly without harming it thermally and (III) the essential technical know-how to manage arising physical effects, caused by the fast switching, like pressure pulsations due to wave propagation etc., in a way that the entire system works as desired. Skilfully integration of such aspects makes it possible to design systems which reduce energy consumption as well as showing high performance and precise pressure, position, force and torque control and less oil volume.

This development is based on scientific results achieved in cooperation projects and various diploma- and PhD-theses which are mostly published.

Impacts and effects

The competence gain in the K2 Center and the direct application of it to the project of Miba Frictec GmbH led to an efficiency improvement of the entire production process. Causing a careful resource usage due to the previously discussed hydraulic loss reduction by leakage reduction. The energy costs are reduced by 3.000 € to 5.000 € a year which corresponds to an approximate CO₂ reduction of 10 tons.



In order to gain a larger market for this technology, special control electronics was developed, the so called DHCU-controller. This electronics makes it easier to bring digital hydraulics in service at new customers. The development is currently used by two different pilot customers. It is applied under very rough working conditions at mobile and offshore applications.

Project coordination (Story)

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Project partner

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