

System for monitoring hydraulic pump systems in forming technology (MonPuForm)

Abstract:

The aim of MonPuForm is to develop a system for inline condition monitoring to provide knowledge-based support for the operation of hydraulic pumps used into hydraulic servo presses. The basis is a sensor system to be developed, which will be integrated in the hydraulic drive system. Here, measurable wear indicators are to be developed as the basis for the evaluation algorithms. In addition to the linking of sensor data with technology-specific process and machine data, the evaluation algorithms for automated detection of the wear condition and critical operating conditions offer great potential for smart monitoring.



Countries involved



Application sectors

Capital goods, Industrial components, Forming technology

Research and innovation domains

Smart & adaptive manufacturing systems, Digital, virtual and efficient companies

Total cost in M€ (millions)

1,1751 M€

Starting date

01/04/2024

Duration (in months)

24 months

Project leader

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Project participants

RISE Research Institutes of Sweden AB [SE], IPercept Technology AB [SE], HyP-neu GmbH Hydraulik und Pneumatik [DE], Fraunhofer Institute for Machine Tools and Forming Technology IWU [DE], Gedia Gebrüder Dingerkus GmbH [DE], Bucher Hydraulics GmbH [DE]

RATIONALE OF THE PROJECT

Hydraulic servo presses are widely used to produce various industrial components by forming technology. These systems are characterized by a drive concept, which combines high power density and force capability with flexibility of movement. Although monitoring solutions for individual hydraulic components are currently known, they do not offer sufficient information fidelity, since for reliable detection and prediction of the wear condition of hydraulic pumps, the monitoring of the hydraulic systems at system level would have to be correlated and should be combined with machine data and information from the forming process. Such a monitoring system is not yet known and is therefore to be developed in this project. It will then be possible to comprehensively identify the wear condition of the hydraulic pump and make it transparent. Machine loads can thus be objectified, and the lifespan of the hydraulic pumps can be greatly extended. By utilizing the developed monitoring system, maintenance costs for servo hydraulic presses are expected to be further reduced, enabling more sustainable operation.

TECHNOLOGICAL INNOVATION, ACHIEVEMENTS AND RESULTS

Main goal of MonPuForm is the development of a system for inline condition monitoring and provision of wear-describing parameters to enable predictive maintenance of hydraulic pumps used in hydraulic servo presses. The basis is a sensor system to be developed for the acquisition of the necessary information, which will be integrated in the hydraulic pump system. Unlike previous systems, the fusion of this sensor data with technology-specific process and machine data represents a core functionality of the system. One key element is the development of evaluation algorithms for automated detection of wear condition as well as critical operating conditions and overload during press operation. This offers great potential for smart monitoring of hydraulic machine components in the described field of requirements for modern hydraulic servo presses.

As a result, the condition-relevant information provides early information about upcoming maintenance and necessary repair work and thus increases the plannability, plant availability and productivity of such forming plants. Furthermore, it is being investigated whether the data obtained in this way can also be used for process monitoring. This could also support production ramp-ups and failure cause analyses. Furthermore, the information and data can be used to deepen or redefine existing business relationships between plant manufacturers and plant operators as well as to develop new business models using the emerging monitoring system.

MARKET POTENTIAL

Hydraulic drives are widely used technical systems, like plastics and paper machines, marine and wind energy plants, machine tools and forming presses. In this context, forecasts an average annual growth rate of 4.3% in the global market for hydraulic systems up to the year 2026. Market analysis shows the forecast revenue for the fluid power industry (year 2025: 7.5 billion €). Here, the project is oriented to the capital good and industrial components and aims to deliver the following products / methods / services after its conclusion:

- Servo press technology with integrated inline condition monitoring system
- Inline condition monitoring system MonPuForm for hydraulic systems
- Algorithm sets for automated condition and process monitoring.

These developments will directly impact in three different markets: the hydraulic system market to be exploited by HyPneu, the forming press market, where AP&T press builder is present, and the industrial monitoring market exploited by IPercept.

IMPACT POTENTIAL

MonPuForm will develop a method for developing and integration of sensor elements in highly stressed environment like hydraulic pump systems, which can be applied in different manufacturing scenarios. Furthermore, the algorithm set for automated inline monitoring can also be applied for cyclic manufacturing processes. As a result, the condition-relevant information provides early information about upcoming maintenance and necessary repair work and thus increases the resource as well as energy efficiency and productivity of manufacturing systems. Moreover, the information offers great potential for further analyses, applications, and data-oriented services like pay-per-x models.

