ReziProK

Resource-efficient Circular Economy – Innovative Product Cycles

ReLIFE

Adaptive Remanufacturing for Life Cycle Optimization of Capital Goods

Resource-efficient Circular Economy – Innovative Product Cycles (ReziProK)

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Against the background of globally increasing resource consumption, the Adaptive Remanufacturing approach in ReLIFE aims at increasing resource efficiency by extending the life cycle of capital goods. Therefore, the application of maintenance measures is optimized in technical, economic and ecological terms. Measures are controlled based on Condition Monitoring to maintain a defined productivity level of the machine.

Project demonstrator: Exhaust air purification system.

Resource-efficient life cycle extension

The research project ReLIFE aims at increasing resource efficiency by extending the life cycle of capital goods. Therefore, the innovative approach of Adaptive Remanufacturing is developed. It describes an adaptive maintenance strategy, which determines the optimal time and scope of maintenance and remanufacturing measures based on sensor evaluations under technical, economic and ecological aspects. In the course of ReLIFE, a prototype application is developed as a demonstrator based on an existing capital good. Furthermore, business models based on Adaptive Remanufacturing are developed enabling companies to generate competitive advantages. Thus, the prerequisites for the successful implementation of the approach in industry are created.

Innovation of Adaptive Remanufacturing

The innovative character of Adaptive Remanufacturing lies in its adaptability in terms of time and scope. Based on the monitored wear conditions of components, preventive maintenance and remanufacturing measures are proposed situation-specifically. The performance assurance of capital goods is the basis for innovative business models ensuring long-term productivity. The agreed minimum performance level of the machine is maintained through purposeful maintenance measures.

Simultaneously, product design guidelines focusing on integrated sensor technology are developed and implemented in a physical demonstrator. On this basis, a decision support model is designed and implemented in a software application to determine the optimal usage of remanufacturing measures. At the same time, business models are developed based on Adaptive Remanufacturing.

First results

In the course of the project, remanufacturing and maintenance measures have been identified, aggregated, and evaluated in a measure catalog. Additionally, a relevance-indicator was developed to determine the remanufacturing relevance of investment good components. Moreover, economic, ecological, and technical indicators influencing the optimal measure selection were determined in this phase of the project. Based on these indicators, a scheme was developed for decision-making on measure application in specific use cases in order to maximize ecological and economic benefits. The scheme will be validated by means of the demonstrator within the project scope.

The remanufacturing-relevant components of the demonstrator were determined based on a detailed product structure analysis to focus research activities. The

technical properties and the driving wear mechanisms were determined for the components with remanufacturing-relevance. Based on the determined remanufacturing-relevance, which includes the detected wear mechanisms, components, which can be monitored economically, were prioritized. Existing sensor technology within the demonstrator can be used to monitor the condition of some of the components. For the remaining components, a sensor concept was developed and transferred to procurement and implementation to upgrade the demonstrator. For all remanufacturing-relevant components, technically applicable remanufacturing and maintenance measures were identified and narrowed down within a preselection.

Based on the preliminary work, the next step is the development of the central decision model for intelligent measure selection and its implementation in a software application. For this purpose, sensor data as well as economic, ecological, and technical indicators will be taken into account.

Furthermore, three innovative remanufacturing-based business models are being developed within the project. These are product service system-oriented models, which differ primarily in their ownership and responsibility structure.

Another success of ReLIFE is the participation in the 27th CIRP LCE Conference on Life Cycle Engineering with two publications on the project results.

Project content: Upgrade of a capital good to a demonstrator.

Consortium from research and industry

The results are jointly developed by the consortium partners. The Laboratory for Machine Tools and Production Engineering (WZL) of the RWTH Aachen University is the consortium leader and mainly responsible for the development of remanufacturing measures and the decision model for the application of these measures. The Chair of International Production Engineering and Management (IPEM) of the University of Siegen focuses on the development of remanufacturing-based business models. Achenbach Buschhütten GmbH & Co. KG is significantly involved in the construction of the demonstrator with integrated sensor technology.

The results of the project can be utilized within research as well as by national, international and in particular small and medium-sized companies in order to raise economic potentials through the proactive life cycle optimization of capital goods.

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Resource-efficient Circular Economy – Innovative Product Cycles (ReziProK)

As part of the FONA Field of action 6:
The circular economy – efficient use of raw materials, avoiding waste.

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ReLIFE – Adaptive Remanufacturing for Life Cycle Optimization of Capital Goods

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