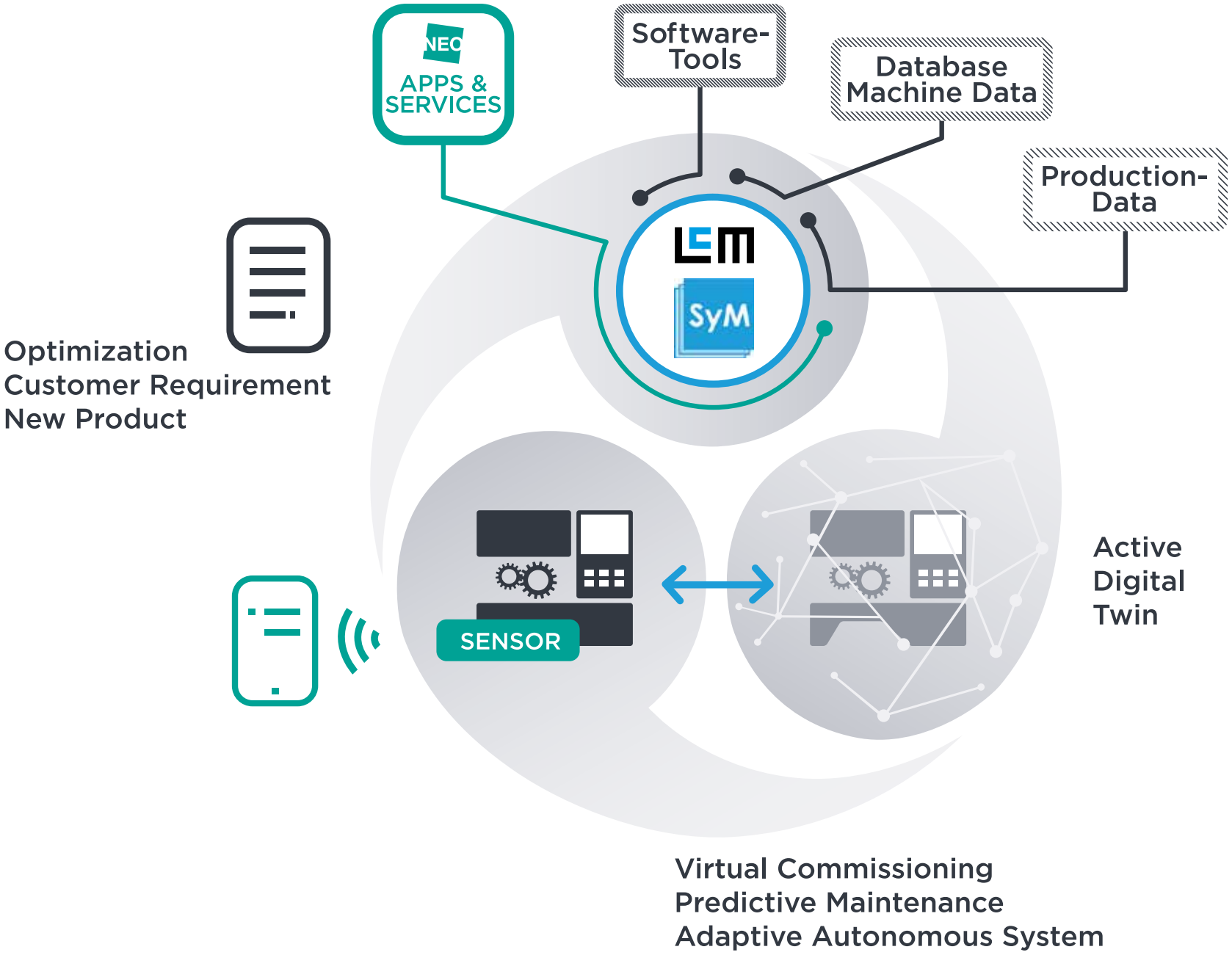
Twin Space by

LINZ CENTER OF MECHATRONICS GMBH

PEPPERL+FUCHS

Digital Advantage from Development to Production

DEVELOPMENT


NEO
APPS & SERVICES
Software-Tools
Database Machine Data
Production-Data
SyM
Optimization
Customer Requirement
New Product
SENSOR
Active Digital Twin
Virtual Commissioning
Predictive Maintenance
Adaptive Autonomous System

CONTENT

Software Platform SyMSpace

SyMSpace is an easy-to-use software platform for the digital development and optimization of mechatronic components and systems. For different technical challenges, SyMSpace allows setting up an automated workflow consisting of construction – simulation – optimization. SyMSpace is cloud-based and thus available to the user at a pay-per-use basis at any time without own expensive infrastructure. With only a few clicks, computing resources can be easily allocated and individually customized. All consumed services are centralized in one single account, clearly arranged and simple.

Applications

- Development of mechatronic components and systems
- Optimization of mechatronic components and systems

What‘s the benefit?

- Reduction of expensive development time
- Reduction of costs in the prototype phase
- Reduced „time-to-market“
- Recalculation of performance data
- Optimized design for production
- Demand-oriented product development
- Attractive pricing models „Pay per Use“
- Modular design – extend functionality step by step
- Easy integration of existing software tools
- Direct result transfer (digital twin) into a finished product
- Cloud or local - no expensive hardware required

Softwaretool - MotorBox

The MotorBox is a library for SyMSpace and contains simulation models for calculation and optimization of electric machines. This library comprises various parametric stator and rotor models for different types of machines. It allows evaluation of load points, calculation of efficiency maps and calculation of driving cycles. Finally, the calculated motors can be automatically exported as FMU (functional mock-up unit) and, thus, integrated into other simulation tools or used as a digital twin.

Applications

- Simulation and optimization of electric motors, electromagnetic actuators, Magnetic bearing, ...
- Calculation of the rotor strength for motors used in high-speed applications
- Thermal design of electrical machines

What‘s the benefit?

- Short development time to find the optimal motor solution
- Documentation and manufacturing data can be generated automatically
- Comprehensive libraries for different motor topologies

SyM

MotorBox

Softwaretool HotInt

HOTINT is a software for the simulation of mechatronic systems. Previously, only individual parts of a mechatronic system, such as mechanical components, actuators or sensors could be simulated. With the help of HOTINT mechatronic systems can be simulated as a whole. In addition there is the option of coupling HOTINT with other software tools, such as for flow simulation, component networking, closed-loop control.

Applications

- Free tool for the simulation of complex mechatronic systems
- Static / dynamic / modal analysis
- Realistic models of flexible components
- Versatile coupling of components and bodies
- Parameter identification & optimization

What‘s the benefit?

- User interface, flexibility and extensibility
- Open interfaces to other simulation tools
- Modular framework for efficient modeling and development of custom elements

Softwaretool TechCalc

TechCalc is an advanced technical calculator. It includes various worksheets dealing with mathematics, electrical engineering, magnetics, mechanics, mechanical engineering and signal processing. These are especially designed to support engineers systematically at their daily work and therefore reduce the mistake probability. Typical worksheets are e.g. design of a hydraulic accumulator, hydraulic cylinder, springs, the calculation of system eigen-frequencies, etc. As a main feature all variables are coupled with physical units and the conversion is done internally. All used design rules and equations are well documented using HTML. Simple calculations can be done using a command line. The “one-click” documentation of all performed calculations, transformations and results tops off the process.

TeC

Applications

- Efficient, fast and error-free design and calculation routines in daily engineering

What‘s the benefit?

- Calculates in all directions (symbolic equation handling)
- Units are always considered
- Calculator (units, numerics, numeral systems)
- Note function for each worksheet
- HTML help
- „One-click“ documentation

Softwaretool X2C- Rapid Control Prototyping

X2C is a model-based development tool and code generator for real-time control of microcontroller and signal processor platforms. C code can be generated automatically from Matlab/Simulink or Scilab/XCos models. Model parameters are tunable in real-time and signals of the running application can be recorded. Libraries with a various graphical elements are available for easy creation of a control algorithm. X2C supports a variety of different microcontrollers from different manufacturers.

X2C

Applications

- Graphical creation of control algorithms on real-time systems (Matlab/Simulink or Scilab/Xcos)
- C-code generator for real-time algorithms on Q-controllers and embedded systems
- Simulation of control algorithms
- Online system tuning and debugging

What‘s the benefit?

- No programming skills required
- Short development times
- Configuration and adaptation of the control system in real time
- Extensive libraries
- Easy documentation creation and commissioning of the system
- Consulting service

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Active Digital Twin

Digital twins are virtual images of real machines and processes. Digital twins based on simulation models can simulate the actual behavior of plants and thus record non-measurable process variables parallel to the production process and determine deviations from the setpoint. An active digital twin also enables bi-directional data exchange between the real process and the virtual model. Based on real measured values, process parameters can be adjusted during production and optimized on the basis of criteria such as quality, energy efficiency, cycle time and costs. Using special model reduction methods real-time models can be realized.

Applications

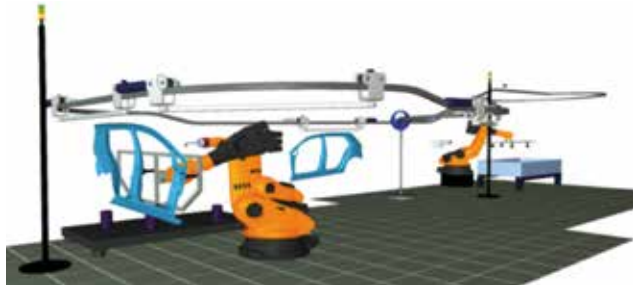
- Manufacturing plants
- Manufacturing machines
- (Sub)systems and processes

What‘s the benefit?

- Efficient digital product development process
- Accelerated planning and commissioning cycles
- Process Monitoring and Predictive Maintenance
- Adaptive production process through active digital twin
- Adaptive autonomous systems – self-adapting machines/processes/models
- Reduced error and improved product quality

Virtual Commissioning
Predictive Maintenance
Adaptive Autonomous Sy

Virtual Comissioning



Fotos: www.machineering.de

Normally, commissioning starts after the plant has been built up and connected to the automation system. Virtual Comissioning enables these phases to be parallelized, reducing time and costs. Based on 3D design data, a digital copy of the plant is generated. By coupling this virtual plant in a 3D simulation environment with the real automation hardware, the automation software can be developed, tested and optimized. As a result, software errors can be detected earlier, and the risk and effort involved in real commissioning can be reduced. However, the benefits of the virtual plant go beyond the commissioning phase. The parallel operation of the simulation and the real process results in far-reaching possibilities, e.g., collision detection or predictive maintenance.

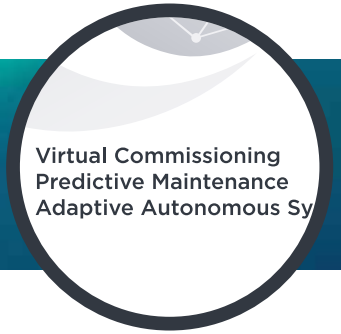
Applications

- Pre-commissioning of the automation on the virtual prototype (Hardware in the Loop)
- Optimization of the process flow
- Lookahead simulation parallel to the real process
- Predictive Maintenance

What‘s the benefit?

- Shorten the development process
- Time and cost savings
- Effort and risk minimization
- Increase the quality of the software
- Shorter real commissioning
- Optimized / safe operation

Predictive Maintenance



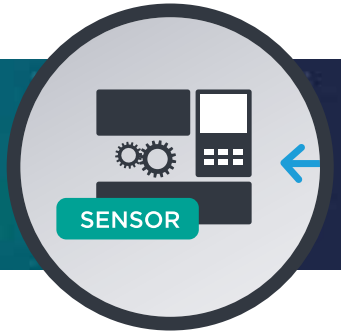
Predictive Maintenance (PdM) methods are used to determine the state of machinery (parts) and equipment (components). These are usually wear parts where either no direct inspection is possible, whose failure due to the high degree of automation and the short service life would require a production stop or which are prematurely exchanged for fear of an impending production stop. However, most of the wear can't be determined on a single sensor, but it must be a combination of sensor and operating data used to determine the optimal maintenance time. With PdM methods, servicing can be planned and cost-effectively carried out, since the necessary spare parts can be procured in good time based on the knowledge of the time of failure and the cause of the failure.

Applications

- Assembly line manufacturer
- Mechanical engineering
- Assembly line operators
- Assembly line automation

What's the benefit of PdM

- Increase in production capacity
- Quality improvement
- Reduction of maintenance costs
- Savings of maintenance personnel
- Reduction of production bottlenecks
- Possibility of automatically triggered servicing by maintenance service providers
- Reducing the inventory of spare parts



Sensorik4.0®

Pepperl + Fuchs introduces a new generation of sensors, which are suitable for use in Industry 4.0. The focus is on intelligence, identity and communication. Measured values are prepared for direct further processing taking into account environmental conditions, the signal quality is evaluated and provided as a parameter. Each sensor can be uniquely identified, assigned to its location and given a meaningful name. In addition, information about the condition is determined and provided.

Applications

- Factory Automation

What‘s the benefit?

- Plant fitness for Industry 4.0
- Facilitate plant maintenance

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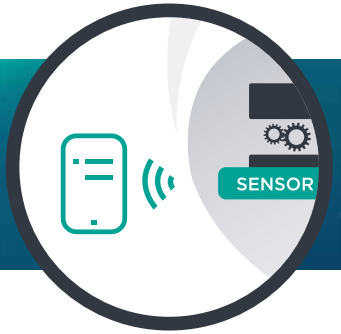
SmartBridge Remote App



SmartBridge technology provides an advanced, radio-based access channel („Data Access Channel“) to sensor and actuator data from a machine or plant. This access channel is mounted in the supply line between the machine control and an IO-Link-capable terminal. At this point, the system uses the digital signal without feedback from the IO-Link-capable device and sends it via Bluetooth either to a mobile device or another Bluetooth receiver, which is a gateway to the Internet. The original communication channel of the terminal for machine control remains completely unaffected. With the extended, radio-based access channel, the SmartBridge system provides an important basis for networking with industrial sensors and actuators - in line with „Industry 4.0“.

Applications

- Factory Automation
- Process Automation

What‘s the benefit?

- Easy commissioning of machines and systems
- Convenient parameterization of IO-Link devices
- Quick troubleshooting in case of repair or maintenance
- Condition monitoring of IO-Link devices

Apps & Services

„Industry 4.0“ refers to the comprehensive networking of all components, machines and systems in the industrial environment. The central component is an easy and secure access to information of all participants. A first step is the secure connection of your system to a central data service. Information that was previously unused or pure at the control level becomes centrally available through Neoception technologies. General applications allow, for example. If your machine not only orders the correct wear parts on time when operating hours have been defined, it will also promptly request maintenance from you.

Applications

- Factory Automation
- Process Automation

What‘s the benefit?

- Secure data connection of your system
- Comprehensive applications
- Intuitive solutions
- Modular solutions
- Building on standardized technologies and open interfaces

Active Digital Twin – Adaptive Technology MAC 2.0

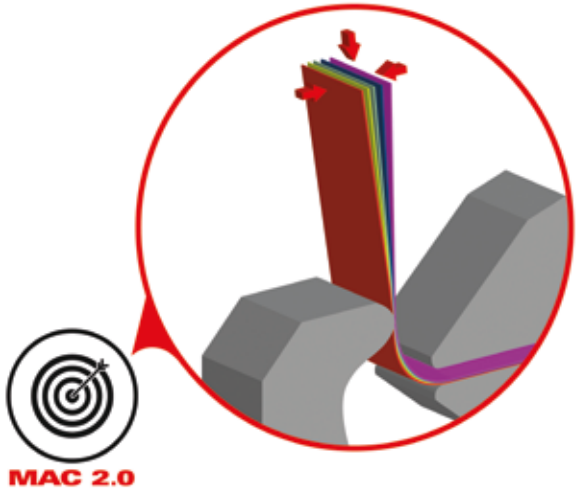
Bending technology, machine type and material are the three factors on which the bending result depends. With MAC 2.0, the panel bender detects material deviations in masked time. If a tolerance value is exceeded, the bladeholder movements are automatically adjusted to compensate for the fluctuations in material behaviour. Thus a constant bending quality is guaranteed even when material quality changes within the same batch and scrap is eliminated even with small production batches.

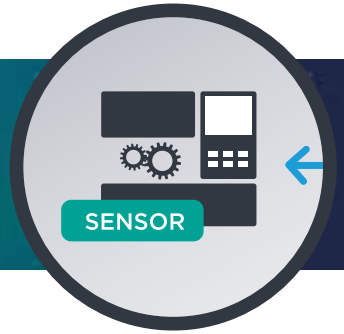
Applications

- Adaptive production process
- Optimized bending process

What's the benefit?

- Constantly good bending quality
- No scrap
- Optimized cycle time
- Widely independent of material quality





Panel Bender P1

The P1 is the smallest panel bender in Salvagnini's product range with a footprint of only 8m² and yet it covers 70% of the potential parts bent on large panel benders. The new, patented kinematics even allows bends that cannot be performed by conventional panel benders . The P1 also scores with remarkably low energy consumption which amounts to a maximum of 3 kW. The universal bending tools eliminate set-up times and the fully automated bending process does not need interventions by the operator. High productivity, extreme repeatability and low investment costs make the P1 attractive for a wide range of industries.

Applications

- Sheet metal forming

What's the benefit?

- Patented kinematics
- High repeatablilty
- Sustainable consumption
- Low investment costs, rapid payback

Notes

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