SIEMENS
Ingenuity for life

Simcenter Amesim for automation

Accelerate co-development of multiphysical systems and control strategies

Benefits
- Accelerate co-development of multiphysical systems and control strategies while maximizing the re-use of simulation models throughout the design process

- Simulate failure scenarios offline without putting lives or machinery at risk

- Enable supervised operation and predictive maintenance

- Make the right decisions using fast simulation models fed with parameters from the field

- Create realistic operator training systems that reflect the dynamic effects of your real machine or process

- Optimize the green efficiency of production machines, taking control logic into account

Summary
For process automation industries (such as oil and gas and chemicals), discrete automation industries (such as pharmaceuticals, wind power and automotive) and machine industries (such as packaging, bottle filling, metal forming and textile machinery), it is critical to find the best combination of attributes when you have to consider:

- Safety to limit risks to human lives or equipment

- Productivity to reduce production costs

- Accuracy to limit the rejection rate

- Reliability to maximize the production time

- Green efficiency to reduce the total cost of ownership (for example, by minimizing energy consumption) and comply with local environmental regulations

As a consequence, industrial equipment companies have to size mechatronic systems (including hydraulics,
pneumatics, electrical, mechanical and thermal aspects) as well as associated control strategies to increase productivity. This should not impact the quality of the product or the accuracy and reliability of the machine. In addition, tracking energy losses is important when optimizing existing systems or when developing new, more energy-efficient ones.

The global machine performance is strongly linked to the interaction between physical systems and their controllers. In this context, Simcenter Amesim™ software enables system engineers and automation engineers to start the evaluation and validation phases earlier in the design cycle. Tight integration of a machine model and an automation program for software-in-the-loop (SiL) and hardware-in-the-loop (HiL) helps eliminate uncertainty resulting from late error removal.
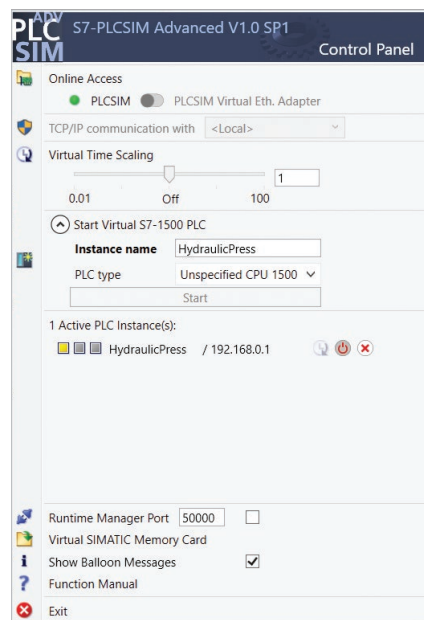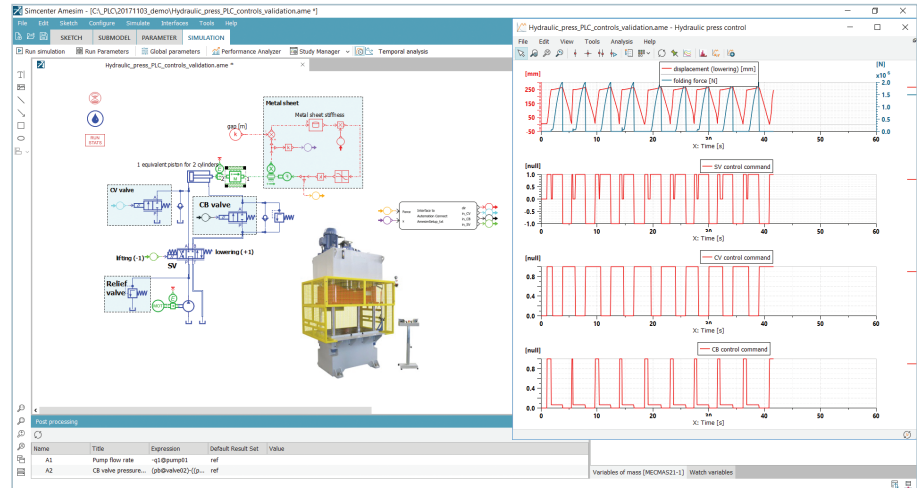
Building your digital twins with Simcenter Amesim
Simcenter Amesim is a graphically interactive platform for the holistic modeling, simulation and analysis of mechatronic systems from 0D to 3D. It offers 48 libraries (approximately 6,500 off-the-shelf submodels), including physical ones (mechanics, fluids, electrics, thermal hydraulics, pneumatics, etc.) and more application-oriented ones (powertrain, cooling systems, cams and followers, batteries, etc.).

www.siemens.com/plm/simcenter

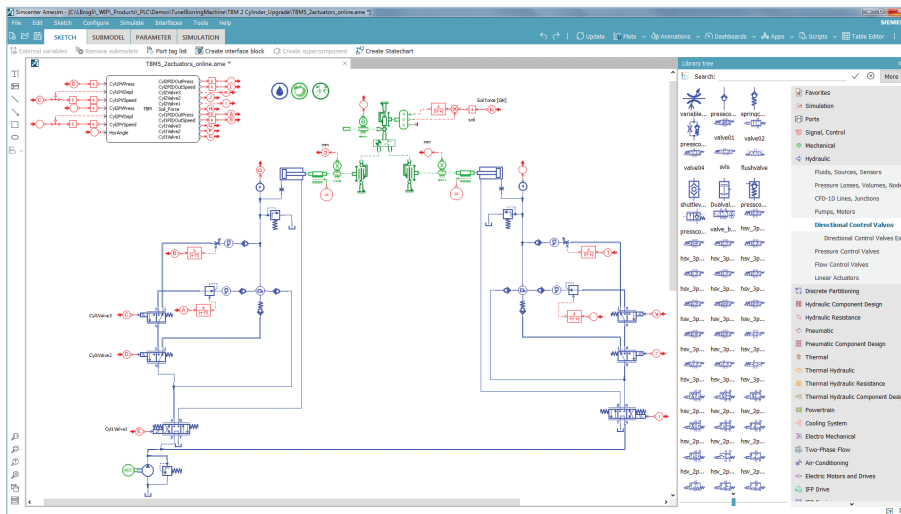# Simcenter Amesim for automation

Features

- Connection with real automation and drive controllers such as Siemens SIMATIC PLCs, SIMOTION and SINUMERIK for HiL applications

- Support of Profinet and Profibus communication through a SIMIT UNIT hardware gateway

- OPC-UA client provided for broader connection capabilities

- Connection to SIMIT Virtual controllers and PLCSIM Advanced for SiL applications

- Connection to NX Mechatronics Concept Designer for enhanced 3D kinematics

Thus, Simcenter Amesim supports a wide variety of domains, especially domains that are applicable to the industrial machinery market. The transient analysis capabilities of Simcenter Amesim enable you to tackle slow thermofluid processes as well as fast metal-forming applications.

Although the complexity of a Simcenter Amesim model is suitable for analyzing energy flows, it might nevertheless require fine-tuning, especially for achieving real-time models. This is why various model simplification tools are available both in the time and frequency domains. They provide insights into the dynamics at play and allow you to achieve real-time capabilities while preserving the physical relevance of models. In Simcenter Amesim, the modeling, simulation and analysis processes are streamlined by advanced, yet user-friendly, pre- and postprocessing tools, such as interactive dashboards, 3D animations, extensive plotting functionalities and even computer-aided design (CAD) import capabilities. Thus, when connected to your virtual or real automation devices, Simcenter Amesim facilitates the creation of meaningful human machine interfaces (HMIs) to monitor or interact with the digital twin of your machines to serve all your SiL or HiL use cases.
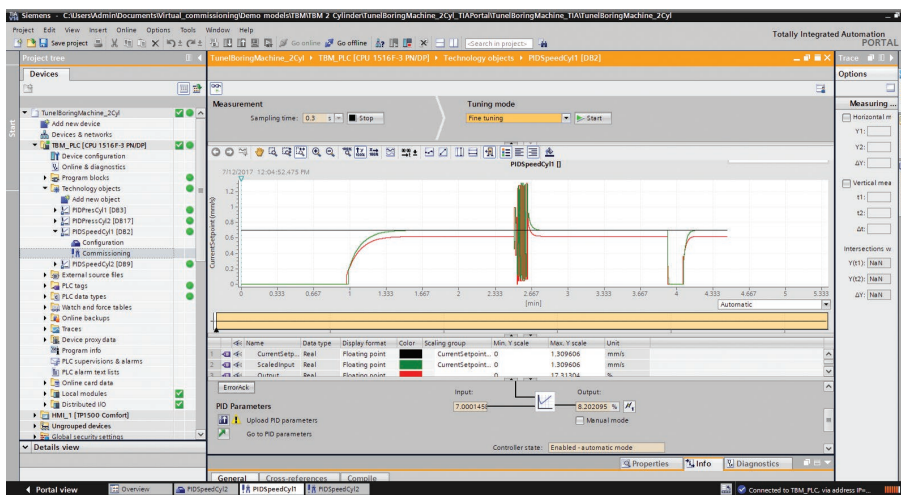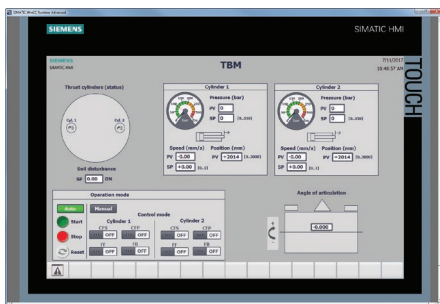
transient dynamics of multidomain systems directly coupled with the automation program (SiL) or the real programmable logic controllers (HiL). Typically, the impact of a programmable logic controller (PLC) code modification on the overall or energetic-only performance can be quickly and efficiently evaluated before the physical equipment exists. This increases flexibility and reduces development risks.
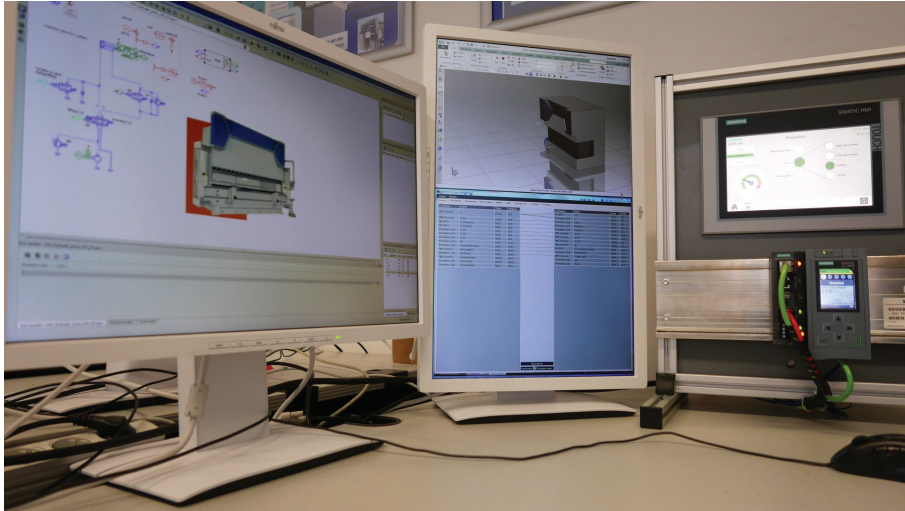
The sizing of the many multidisciplinary subsystems and the PLC code can be jointly optimized to reach predefined performance and energy consumption targets. Also, once an optimal design has been found, the time needed to fine-tune the automation code on the real equipment during the commissioning phase is reduced. As a consequence, industrial machinery and process industry actors can drastically minimize development cost and duration.

Supporting development processes
Concurrent engineering between mechanical and automation departments is the key to speed up your time-to-market. Be it for the development of a process or a machine, creating a valuable virtual test bench to reach product maturity earlier is now possible. This consists in using Simcenter Amesim to simulate the

Retrofitting a machine or process enables savings on capital expenses while benefiting from new technologies. The usual objective of the retrofit is to increase daily production, improve quality and reduce energy consumption. The retrofit often includes the replacement of the automation equipment – motors, drives and controllers. Retrofit costs are strongly linked to production downtime. Hence, reducing this nonproductive phase by being able to predict potential issues before applying modifications to the real equipment is key. SiL and HiL techniques help the user anticipate controller integration aspects through the coupling with a virtual model of the equipment. Mastering issues upfront thanks to simulation avoids unexpected delays and limits the repair costs due to additional downtime.

Predictive maintenance

You can perform operation supervision and predictive maintenance using a Simcenter Amesim digital twin of the machine. This process paves the way towards significant productivity gains.

This approach uses automation devices to feed a multiphysical model with parameters obtained from the field, and execute predictive simulation runs in parallel.

Supporting plant operation

Process industries operate 24 hours a day, 7 days a week. To maximize productivity, it is important to maintain the expected throughput with the same quality and production costs. In addition, the process controls often have to be adapted due to a change in the production (different material or quality requirement, etc.).

For industrial machines, component aging is a reality and maintenance has to be anticipated in order to limit pauses in production.

Simulation allows you to predict the future state of the equipment, thus suggesting (decision support) or applying (closed-loop control) modifications to the operating conditions. The main benefit is to better adjust the operation of the equipment for maximum profitability while relying less on the expertise of specifically-trained employees.

In addition, a Simcenter Amesim digital twin can provide additional simulated information when the real information is not, or cannot be, monitored. Reducing the number of real sensors can also be considered when monitoring is difficult or costly. Virtual sensors enhance the level of information on the current state of the machine (condition monitoring), which allows for additional safety loops in the automation program. Lastly, the behavior of the digital twin can be compared to the real values of the machine to detect deviations on the components or on the performance of the systems during normal operation. It can be used to discover malfunctions, predict failures and plan maintenance.