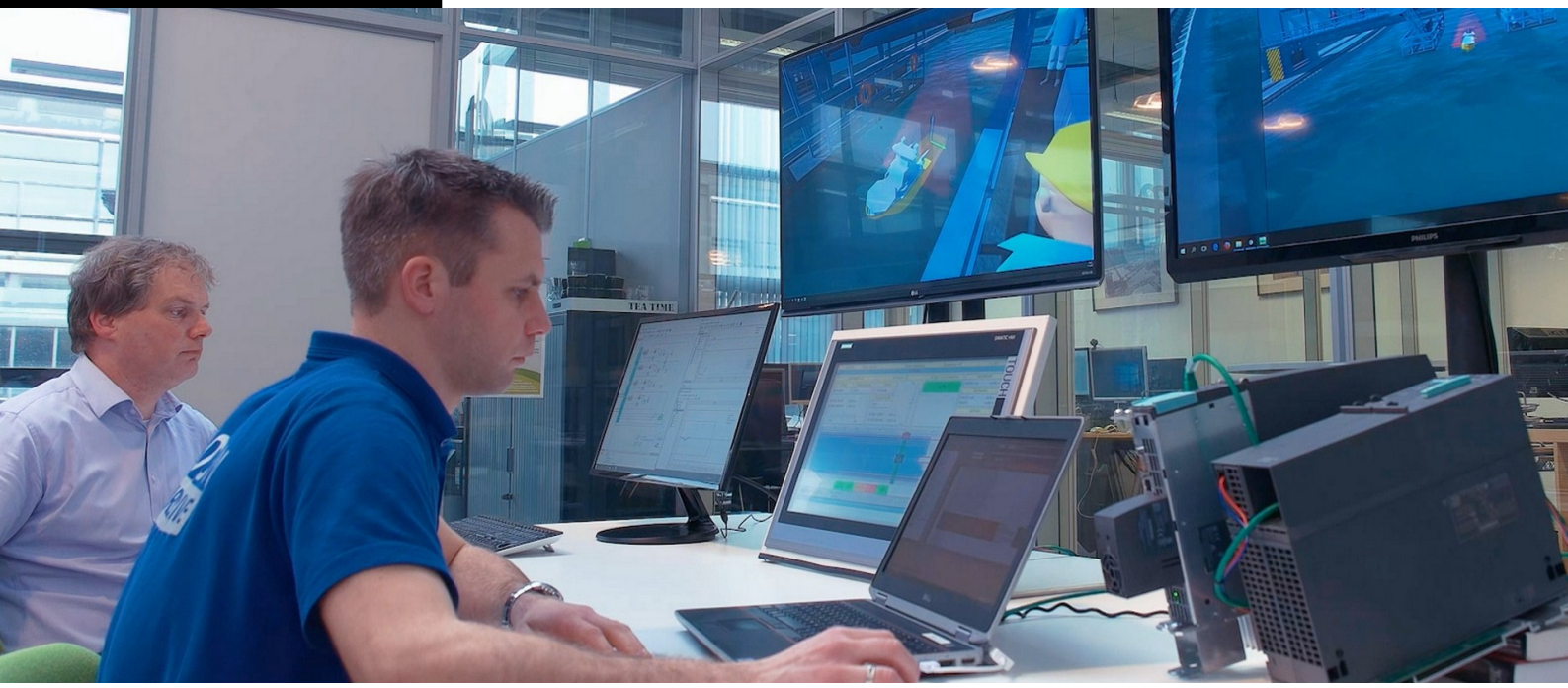
controllab | products

HIL Simulation



HIL Simulation

Hardware-in-the-Loop (HIL) simulation is a technique that is used for the development and testing of complex control systems. With HIL simulation the physical part of a machine or system is replaced by a ”digital twin”: a simulation of the real system.

Benefits

Developing a digital twin simulation and running a HIL-simulation is costly and requires considerable effort. But HIL simulation also offers proven benefits:

- Increase safety: Testing scenarios that would be potentially dangerous on the real machine.
- Save costs: Testing scenarios that are expensive to do on the real machine.
- Save time: Finding errors early during the design saves a lot of time.
- Human in the Loop: Testing how humans interact with the system
- Enhance quality: Finding errors early means that there is time to find solutions.

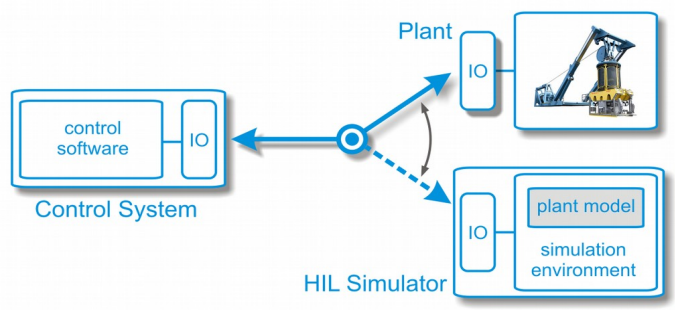
HIL simulation is therefore typically applied for costly machines with complex control software. Controllab is specialized in model based design and HIL simulation. We can build digital twin simulations and carry out HIL simulations to test your machines.

Technology

Computer controlled machines have a physical part (which we call the *plant*) that is connected with the *control system*, through actuators and sensors. With HIL simulation the plant is replaced by a simulation model (which we call the *HIL simulator*). If the *HIL simulator* is designed well, it will accurately mimic the real *plant*, and can be used to test the *control system*. Therefore it is also named *HIL testing*.

A pure HIL simulator will mimic the plant at the connection level and allows all wires to be switched from

the plant IO to the HIL simulator IO. Typical control systems have many wires requiring an extensive set of IO at the simulator. Therefore in practice HIL simulators will be connected at the fieldbus level. This reduces the simulator IO to a bus driver and reduces cost significantly.



Controllab can provide HIL simulators for control system hardware which provide an open fieldbus. This can be PLC's but also embedded systems.

Towing Carriage

The Seakeeping and Manoeuvring Basin of MARIN allows model ships to run independently in waves, followed by a towing carriage containing measurement equipment. The carriage has been refitted by VSE with a state-of-the-art control system. Controllab has tested this control system using its Hardware-in-the-Loop (HIL) simulation technology.

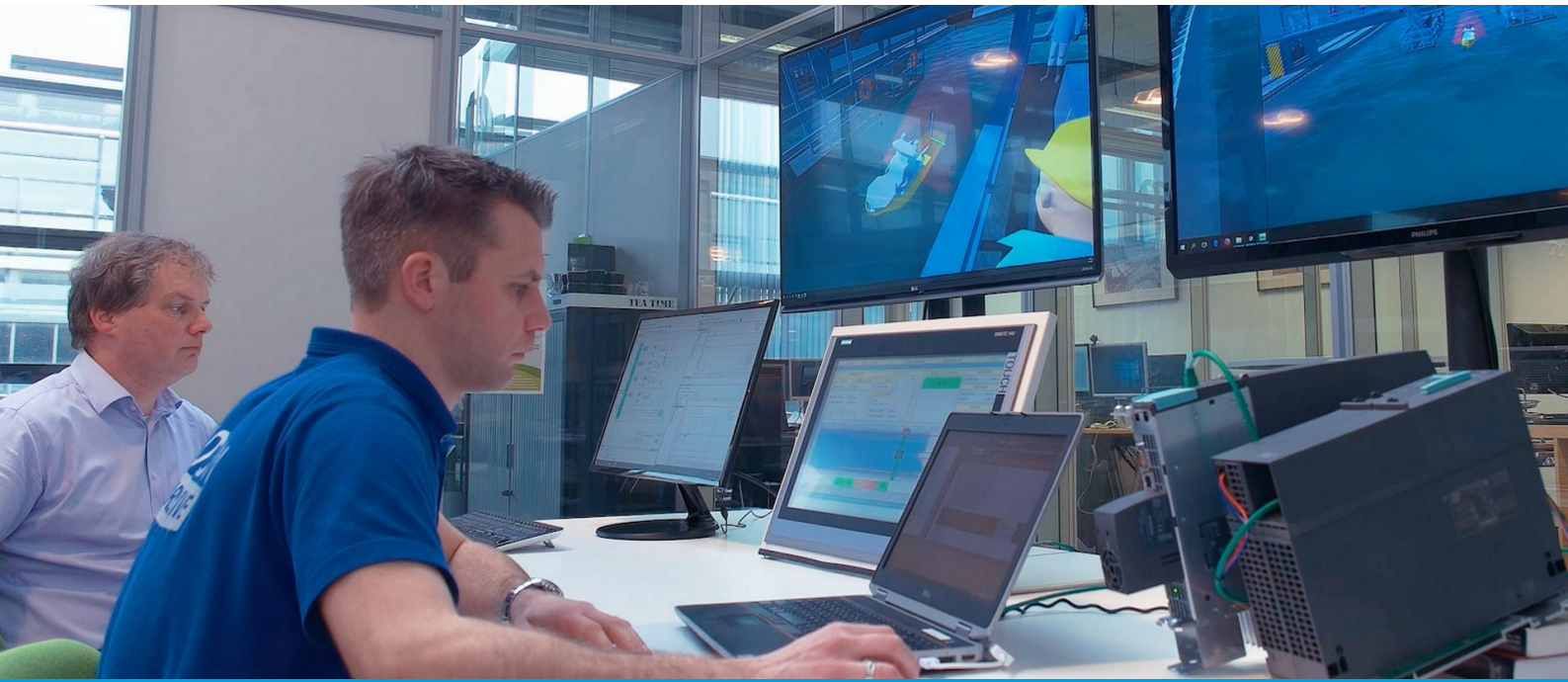
For VSE, Controllab developed an accurate simulation model of the carriage. By coupling the simulator with the control system running on a Siemens PLC, tests were carried out. This allowed VSE to solve errors and increase the quality of its control system. It also allowed VSE to run scenarios that would potentially damage the real carriage and see if the control system would prevent this. Using HIL simulations, 90% of the FMEA could be carried out.

This enabled VSE to perform the actual refit in a two weeks window and return the towing carriage in good order before deadline.

Access Bridge

SMST provides a range of Telescopic Access Bridges (TAB) that can transfer personnel safely to an offshore structure or the quay side. For the TAB, Controllab has developed a HIL simulator.

For the HIL simulator of the TAB, Controllab coupled the control system PLC to a simulation model of the bridge. By adding a 3D animation of the bridge a good overview of the simulation was presented. This allowed a large set of destructive and non-destructive scenarios to be simulated to test the performance and safety of the control system.



As a result the bridge was commissioned and sent to the ship in a record braking time, where it performed flawlessly. Convinced by this success, SMST has fully adopted HIL simulation to develop a whole range of motion compensated access bridges and cranes.
Two of the HIL simulators have been equipped with 3D visualization and represent the plant so well that they are now used as training simulators.

Boom Lock

The company High Wind (a subsidiary of DEME) has developed the Boom Lock system. It is a tool that allows an offshore crane to install wind turbine components at high wind speeds. The Boom Lock consists of a trolley that can travel up and down the crane boom to catch and secure the crane hook. The system is equipped with horizontal and vertical taglines to control the orientation of the load and damp out oscillations.

This makes the control system of the Boom Lock quite complex. Verifying the correct and safe operation of the controller would require scenarios that are potentially dangerous for the crew on-board and the integrity of the crane. That is why HIL simulation was used developed by Controllab. In three weeks time the whole control system was tested, corrected for errors and ready for use.

The implementation on ship was quite successful. After two weeks of work the first wind blade was lifted. The Boom Lock could stabilize the wind blade in wind speeds up to 15 m/s. Since 2015 the Boom Lock system is in full operation and used for hoisting wind blade, nacelles and other loads.

Contact Us

Controllab has been active in HIL simulation in the High Tech Systems and Offshore market for more than 15 years. We have excellent tooling and experienced engineers to develop HIL simulators for a wide range of applications. This will help you to test the next generation machines and ensure a quick and successful commissioning.

Contact Us

Controllab Products B.V.
Hengelosestraat 500
7521 AN Enschede

controllab.nl
info@controllab.nl
085 773 18 72