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Domain and Problem

In the offshore and maritime industry, the level of automation is continuously increasing. A good example is a gangway that has to compensate the ships motion to deliver passengers safely to a fixed platform at sea. The demand for motion compensated systems is increasing rapidly with the advance of wind turbines at sea. Controllab Products BV develops and implements these control systems for crane and gangway manufacturers.

Figure 1: Motion compensated gangway (picture courtesy of SMST).

The technology of Controllab centers around the in-house developed simulation package "20-sim". With 20-sim you can model and simulate cranes and gangways including the control systems, hydraulics and mechanics. We do this by taking a model-based design approach. Model based design allows control engineers to design and test their control software early using simulations. It is an efficient approach for the entire design process with a good industrial track record for safety critical systems.

The control systems developed with model-based design are complex with a high degree of automation. Quite different from the manual operated systems from the past. This motivated our customers to look for new ways to train people in using their systems.

How did INTO-CPS help?

The H2020 project INTO-CPS focuses on the development of an integrated toolchain for model-based design of cyber-physical systems. The heart of the project is the development of a co-simulation engine that uses the FunctionalMock-up Interface (FMI) standard to couple simulation models, which comes from the automotive industry originally developed in the Modelisar ITEA project.

Controllab participated in the INTO-CPS project by implementing the FMI standard in 20-sim. This allows users of 20-sim to export models from 20-sim using the FMI standard and use them in the INTO-CPS co-simulation engine. One of the results of the INTO-CPS project was that we realized that the FMI-standard can be used for

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the general exchange of simulation data. We therefore developed an FMI interface for Unity. Unity is 3D engine that allows game designers, video editors and apps developers to show content on screens and VR headsets. With the FMI interface we can use Unity to show simulation results real-time in 3D on screens and using VR headsets. The results are so realistic that it gives you the impression that you are operating the real-machine, and thus can experience the product before it exists!

Impact

We have used the FMI interface in Unity to couple 20-sim simulations of a crane and show the results in 3D. The figure below gives an impression. With 20-sim we can simulate the motion of the ship, the hydraulics of the crane and the motion compensation to isolate the passenger from the movement of the ship. With Unity we can show all of that in 3D and make it real-life by adding all kinds of objects and effects.

Figure 2: 3D real-time simulation of a motion compensated crane.

Mid-2017 we started with a roadshow by visiting our crane and gangway customers. We showed them how this technology can be used to train working with these machines. We also found out, it would help them in the process of selling new disruptive visions. So far, two VR-setups have successfully been used at trade fairs and the first commercial training simulator is under development.

More information:

- www.controllab.nl
- www.20sim.com
- www.into-cps.org

Movies:

- http://www.controllab.nl/wp-content/uploads/SMST-Access-Bridge.mp4
- http://www.controllab.nl/wp-content/uploads/Offco-OPTS.mp4