AGCO Fendt

Automated testing of tractor controllers using Hardware-in-the-Loop test benches

speedgoat
real-time simulation and testing

Using Speedgoat Hardware-in-the-Loop rack systems together with Simulink Real-Time to automate and enhance the testing of complete software systems for tractors

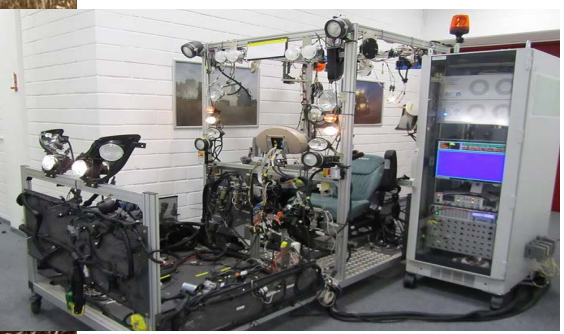
Introduction

AGCO Fendt is an agricultural equipment manufacturer based in Marktoberdorf, Germany. It was founded in 1937 by Xaver Fendt and purchased by the AGCO Corporation in 1997.

AGCO Fendt offers a range of tractors, combine harvesters, hay and forage equipment. Their transmission gearboxes are widely regarded as the most fuel efficient on the agricultural market.

The quantity of software in modern tractors is constantly increasing due to the higher number of electronic control units, and greater functionality that needs to be implemented. This results in more complex test requirements and test scenarios, which make Hardware-in-the-loop (HIL) testing more and more attractive as development time can be reduced, and testing round the clock becomes possible.

Models for HIL testing need to operate as close to reality as possible, so that complex test scenarios and test cases can be realized.



AGCO Fendt HIL test bench

Test benches

To accommodate this, AGCO Fendt introduced new HIL test-benches which include real-time target machines from Speedgoat and a tractor model designed in MATLAB® and Simulink®.

The Speedgoat real-time target machine simulates all sensor signals, and processes the incoming actuator signals. Physical connectivity is realized in the system through I/O modules that are flexibly added to the system to replicate devices in the tractor.

The tractor model contains I/O driver blocks, and simulations of the power lift, the power take off, and the hydraulic valves.

Drivetrain Model

The drivetrain and the engine models are designed with LMS AMESim, which is a software package for multiphysics simulation, providing tools for modeling many different physical systems, and predefined components for many physical domains.

With LMS AMESim:

- Models are easily parameterizable for various transmission types
- Features are provided for the simulation of vehicle dynamics (e.g. loads, tires, steering)
- Importing into the MATLAB / Simulink environment is easy with a flexible interface between the two products

AMESim can require a lot of computing power; Speedgoat real-time target machines with the latest Intel CPUs, are well suited to the task.

Benefits

Some software functionality is very similar across several tractor types. For example residual speed control, which checks for unsafe situations arising if the tractor runs too fast. With the HIL system this functionality can be quickly and safely tested in all tractor types by switching parameter lists for the drivetrain model type, and by using an automated routine to flash ECUs.

Tractors that were previously tied up for software testing are now available for other tasks, such as fine-tuning the driving experience.

With Hardware-in-the-Loop, testing begins when the tractor is in the early stages of development. This accelerates the development process, allowing rapid changes to be made based on driver feedback, and improving the quality of the final product.

Simulink Real-Time together with Speedgoat hardware systems enabled AGCO Fendt to implement a complete testing solution, including LMS AMESim multiphysics simulation.

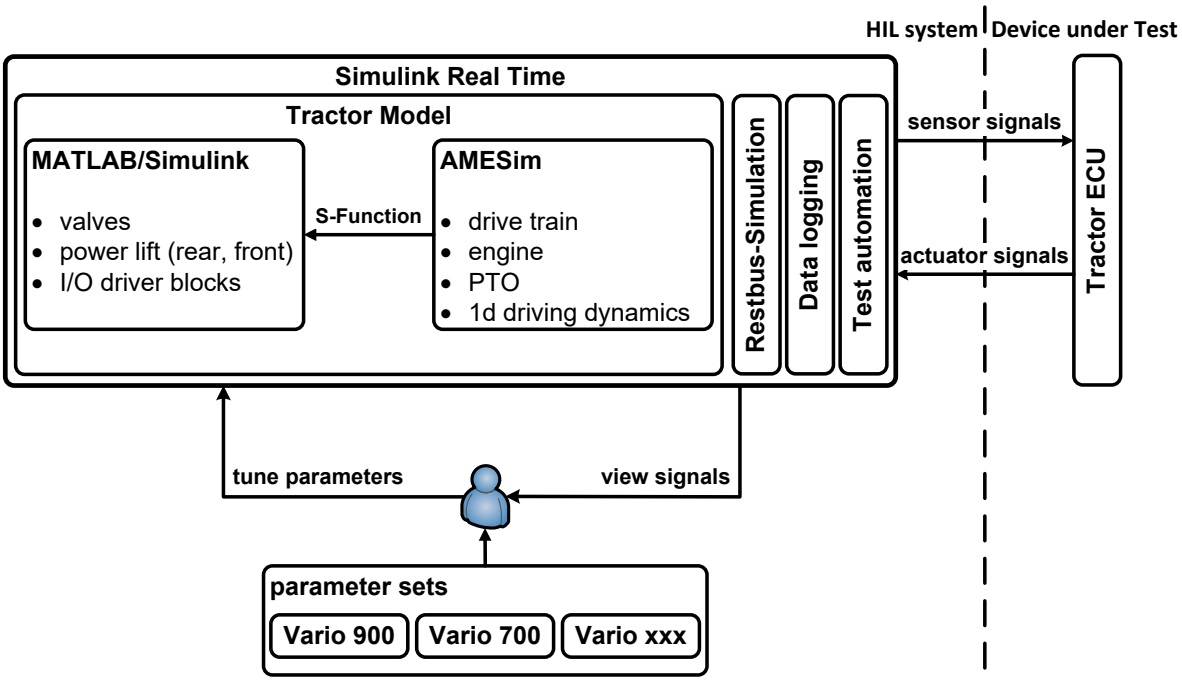
Speedgoat's contribution

"Speedgoat systems offer state of the art performance with application level support included, enabling detailed modeling of the tractor environment for ECU testing and development" - Mr. Weinbuch

"Simulink Real-Time and Speedgoat hardware are expressly designed to work together, enabling us to use latest MathWorks software with state-of-the-art Speedgoat hardware, seamlessly integrated and fully tested.

Speedgoat have always provided us with excellent support."

Jürgen Weinbuch, Test engineer: HIL / test automation, Test manager, AGCO Fendt



Overview of the HIL-system at AGCO Fendt

AGCO Fendt

Marktoberdorf, Germany

www.fendt.com

Speedgoat products used

- Performance real-time target machine
- I/O expansion unit
- IO106 16-bit analog input voltage module
- IO110 16-bit analog output voltage module
- IO114 analog output current module
- IO115 analog output module
- IO316 configurable FPGA-based I/O module
- IO601 CAN module
- IO925 high precision resistor simulation module

MathWorks software used

- MATLAB®
- Simulink®
- MATLAB Coder™
- Simulink Coder™
- Simulink Real-Time™

Learn more

www.speedgoat.ch/userstories

speedgoat
real-time simulation and testing