IMAMOTER integrates optimized electronic control units in agricultural equipment with the help of Siemens PLM Software

Plowing ahead

Italy might be famous for Ferrari and the Fiat 500, but it also has a pretty good name amongst farmers with agricultural equipment brands such as the Carraro Group and the CNH Group.

With such a progressive approach to car design, it is not surprising that this innovative attitude pervades the agricultural industry in the shape of IMAMOTER, a research institute from the Italian National Research Council (CNR) IMAMOTER has historical links with Fiat, the Politecnico of Torino, several members of the Italian agricultural and ground vehicle industries as well as academic and research institutions.

Founded in 2002, the Institute mainly promotes the latest best practices in agricultural and ground vehicle machinery design and development to maintain the overall competitiveness of the Italian agricultural industry.

Like other manufacturers, the Italian agricultural industry is facing the issue of how best to integrate electronic controls in agriculture equipment so they can achieve better productivity, improved operator ergonomics and increased energy efficiency and safety.
“There are two factors,” says Massimo Martelli, a researcher in the fluid power and mechatronics department at IMAMOTER. “First, accurate physical modeling of the system dynamics is mandatory to determine critical control strategy parameters. Second, Simcenter Amesim has become a sort of de facto standard for numerical simulation in the fluid power community. Together, this caught my attention.”

Massimo Martelli
Researcher
Fluid Power and Mechatronics Department
IMAMOTER

Saving time and money
So Martelli and his team began modeling. To start, IMAMOTER co-simulated the electrohydraulic systems model using Simcenter Amesim™ software and the control strategy model developed using the MATLAB® environment and the Simulink® environment. Unfortunately, this technique just covered the main points of the control scheme, and not all the specific issues related to an actual engine control unit (ECU) implementation. In other words, it wasn’t real enough.

So the team at IMAMOTER decided to create specific submodels using the Simcenter Amesim submodel editing tool that is designed to help users create well-documented, standardized, specific and re-usable library components.
Creating a virtual test bench for control optimization
Using Simcenter Amesim helped IMAMOTER to uncover the factors behind slow control performances caused by high-cycle periods in the electrohydraulic circuit on the ECU. It also helped the team to find alternative, advanced control schemes specifically in C-language control scheme implementation. Overall, it enabled IMAMOTER to avoid extensive and expensive test rig sessions.

Using Simcenter Amesim, the control routine developed by IMAMOTER was integrated into the specific submodels to validate the impact on system performance, and to refine it. Then, this code was directly implemented in the production of ECUs for final physical validation.

“We were very pleased that this was such a straightforward integration,” says Martelli. “We are particularly happy with the hydro-mechanical simulation capabilities. Today, Simcenter Amesim saves us time and money, and makes it possible to develop conceptual schemes for which experimental activities are not feasible or affordable.”

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Customer’s primary business
IMAMOTER is a research institute that is part of the National Research Council of Italy (CNR), and is a result of the incorporation of two CNR Institutes: the Institute for Earth-Moving Machinery and Off-Road Vehicles, and the Institute for Agricultural Mechanization. IMAMOTER promotes knowledge and provides thought leadership in the design, production and use of agricultural and earth-moving machinery.

www.imamoter.cnr.it

Customer location
Ferrara
Italy