INTERVIEW – Marcus Geimer, Professor for Vehicle Systems Technology, expresses his views on the challenges taken up by the Forwarder2020 project

The Forwarder2020 project is coordinated by HSM, a forestry machines developer and builder located in Germany. In this interview Prof. Dr.-Ing. Marcus Geimer, Professor at the Institute of Mobile Machines (Mobima) at Karlsruhe Institute of Technology (KIT) and specialist in Mobile Machines, takes time to express his views about the challenges taken up by the Forwarder2020 project and the project´s impact on the Institute's general research activities - a great opportunity to learn more about the functioning of the energy-saving crane and simulation methods for mobile machines.

The Karlsruhe Institute of Technology (KIT), is one of the research strongest universities in Germany with nearly 9,500 employees, about 350 professors and more than 25,000 students in 11 departments.

The most relevant research areas of the KIT are energy, mobility and information. The center of mobility system concentrates its research activities in the field of technical developments and on the interaction of man, vehicle and infrastructure. The Institute of Vehicle System Technologies (FAST) is one of the core institutes of the center. The institute has test facilities and laboratories to examine whole machines as well as systems and components.

The Institute of Mobile Machines (Mobima) as part of the FAST and involved in the Forwarder2020 project focusses its research in the field of agricultural and construction machines as well as on municipal vehicles and forestry machines. In the field of methods, Mobima is well recognized in hydraulics and simulation methods.

Short Biography

Prof. Dr.-Ing. Marcus Geimer is Professor for Mobile Machines at KIT in Karlsruhe, Germany. After a degree in mechanical engineering at RWTH Aachen University, Germany, he did his Ph. D. at IHP of RWTH Aachen University in the field of hydraulics. From 1995-2000 he was head of development for hydraulics breakers at Company Krupp Berco Bautechnik GmbH, Germany. Afterwards Prof. Geimer was until 2004 responsible for the construction and customer development of hydraulic valves, pumps and motors at company Bucher Hydraulics, Klettgau. From 2004-2005 he was a professor for Mechantronics at University of Applied Science in Konstanz and started his career at Karlsruhe Institute of Technology KIT in 2005.

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Prof. Geimer, you are a specialist in Mobile Machinery and in simulation methods of hydraulic systems. You are then a key partner in the development of the energy-saving crane and suspension system of the drive as well as simulations of the systems in this project. Why has your organisation decided to join this Forwarder2020 project?

The project itself sounded very interesting because new and today unknown technologies have to be implemented in a forestry machine. The combination of theoretical knowledge and their implementation in a real machine also makes the project for young researchers very attractive.

Furthermore, our experience from different research projects shows that simulation methods combined with a deep knowledge of the technology can help reducing the developing time. This is a key to keep the project in time. Last but not least, the simulation can help during the optimization of a system to be much faster than a simple try-and-error method.

Please briefly describe KIT´s role in the project and the functioning of the different innovations developed by KIT.

The role of KIT can be easily defined as a link between new technologies and their implementation in a machine. As you mentioned above, we have a long history in mobile hydraulic system research and therefore can help implementing the new patented technologies.

On the other hand, we have a deep understanding of the necessity of robust technologies for these machines. Our special knowledge is how to transfer a technology from one business, like construction machines, into another, like forestry.

The crane of the Forwarder2020 will get a new energy efficient hydraulic drive. During operation, there are drives, like the inner boom, where energy can be recovered and at the same time, drives need energy, like the outer boom. If the energy can be exchanged between these drives, the system is more efficient. These exchanges can be done by a hydraulic transformer, which we design and dimension.

The second part we are involved in is the design and dimensioning of the bogie suspension. Here we use our knowledge in the field of simulation to get the best solution. To test many different possibilities would be time consuming and expensive.

What are the main (strategical) objectives of KIT in working on the new Forwarder2020 prototypes?

In the past, Mobima was successfully involved in a number of projects in the field of agriculture and construction. With Forwarder2020 we entered the new field forestry, in which we were not much involved so far, and we were able to contribute our experience in the field of hydraulics and simulation successfully. Many similar technologies used in the field of agriculture and construction also can be used here.

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Up to now, which are the main achievements of KIT in the project?

We were able to verify the functionality of both energy-saving crane and suspended bogie by simulations. All systems, including hydraulics and multi-bodies, were modelled highly detailed to represent reality. The simulation results show that the aspired goals regarding higher energy efficiency and reduced dynamic wheel loads can be achieved with the new Forwarder2020.

What is the connection between the Forwarder2020 project and your general research objectives?

In the field of Mobile Machines we are about ten researchers working at my institute. They are working in the field of drives and control for these machines and share their scientific knowledge if needed in other projects.

Thus, the project Forwarder2020 fits very well into our competences: The crane of the Forwarder2020 will be driven by a more energy efficient hydraulic system, which we simulate and optimize based on the simulation results. Therefore in the project Forwarder2020 we share our knowledge in the field of simulation and hydraulics to improve both the design process and the built forwarder. And our knowledge helps us getting the best solution by always asking if we are doing the right things.

What is your view, as a scientist specialised in Mobile Machines, on the future of forestry machines and forest management in Europe? What paradigms will have to be changed? Where do you see the main changes in a near future?

In my opinion, one of the biggest challenges for the future is to use sustainable technologies. On the background of reducing CO_2-emissions a challenging question is: What sustainable energy storage can be used on mobile machines? Electric batteries are not the first choice, even if they cut their weight by five. Biofuels or sustainable produced gaseous and liquid energy carriers are already today a possible alternative. Methane, as an example, can be produced in a sustainable way and systems for using liquid methane are available in other industry applications. Energy saving methods in addition are an important step into the direction of sustainable energy sources.

What will be the highest impact of Forwarder2020 on the forestry sector and on logging activities in general? (Added-value for foresters and wood industry)

Especially due to the hybrid crane hydraulics, a significant fuel reduction will minimize the operational costs of a forwarder. Due to the new suspension, rough terrain can be managed at higher speed and with less ground load than up to now. The combination of the crane, the suspended bogie and a new drive train results in a more productive and less cost extensive logging process. Furthermore, due to the suspension system, both driver and machine are exposed to fewer vibrations, resulting in healthier working conditions for the machine and its operator.

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