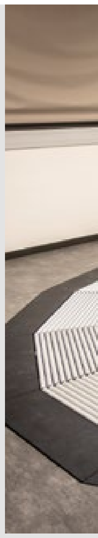
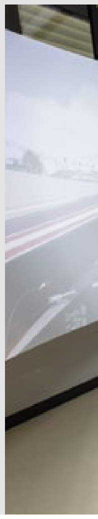
Human-Centered Computing (HCC) Lab





In May, the Human-Centered Computing (HCC) lab opened in the Data House at TU Graz. Laboratory head Eduardo Veas and his team occupy themselves with the needs and behaviour of people when it comes to the development of technologies and computer applications. The HCC lab offers infrastructure that combines virtual worlds of the highest quality with artificial intelligence and robotics:

- An open-plan laboratory to capture motion, including motion capture suits
- VR and AR technology
- The most sophisticated VR motion platform in a research institution in Austria
- Robots for different areas of application
- Race simulators with synchronised recording of physiological data
- Suits for conveying haptic impressions
- Computer hardware and software

This equipment enables the interdisciplinary development and scientific evaluation of applications in the field of human-machine interaction as well as in virtual, augmented and immersive reality or AI – for example in the control of semi-autonomous robots, research into autonomous driving or the design of virtual learning environments.

The establishment of the HCC Lab was funded by the Federal Ministry of Education, Science and Research. AVL Racetech lends the Racing Simulator screen, cockpit and software. ■

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More Reliability for Electronic Components: TU Graz Opens New CD Lab

The CD Laboratory for EMC-Aware Robust Electronic Systems carries out research on the impact of electromagnetic emissions on electronic components in production and operation in order to eliminate the causes of failures.

Falko Schoklitsch

Lunghammer – TU Graz

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1 Movable floor: There is a movable floor in the laboratory so that people can perform movements and overcome distances in the virtual space but remain on a defined surface in the real space. Rollers are built into the floor so that people can walk on them without moving. This makes it possible to explore virtual worlds safely and securely

2 Pet in the laboratory: The robot dog can be remote controlled. It is intended for applications in robotics, telepresence, teleoperation and remote localisation. For example, the robot can independently explore shafts in which dangers such as gases or falling rocks are suspected. Thanks to its built-in sensors, it can comprehensively record and visualise the surroundings, for visualization in VR.

3 Virtual races: Various virtual driving scenarios can be tested in the racing simulator in the Vehicle Human Interaction Lab. Researchers investigate human performance in high demanding driving tasks with physiological sensors. They also investigate algorithms for learning to perform autonomously in simlar tasks.

4 Operation via robot: A robot independently controls the filling level of the demonstration containers with different liquids, which is visualized in AR with head-mounted displays. This allows precise robot operations to be tested.

Electrical components, such as semiconductors, are becoming smaller and smaller thanks to technological advances. However, this reduction in size potentially makes them much more sensitive to external influences such as electrostatic discharges or electromagnetic emissions from other electronic components. This not only increases rejects in production, but can also lead to malfunctions or even failures within an electronic system, such as a sensor in an electric drive unit. In the Christian Doppler lab for electromagnetic compatibility-aware robust electronic systems, which is funded by the Federal Ministry of Labour and Economy, a team led by laboratory head Jan Hansen from the Institute of Electronics at Graz University of Technology (TU Graz) is using modelling based on machine learning to eliminate these problems for components and systems and to put the solutions developed into practice.

Together with corporate partners BMW Motoren GmbH, Infineon Technologies Austria AG and Infineon Technologies AG, Jan Hansen and his team are focusing on two areas: the influences on electronic components during the design and manufacturing process and their optimisation as part of a larger system. "In production, a semiconductor passes through a production line with many working steps and sections where it can become electrostatically charged. If it is defective at the end of production, it is often difficult to determine the cause. In particular, the further miniaturisation of semiconductors presents us with new challenges. We are developing new physical models to describe the various effects in this process and uncover the sources of error," explains Jan Hansen.

FEWER MANUFACTURING ERRORS AND OPTIMISED DRIVE UNITS

Environmental conditions, such as humidity, also play a role in day-to-day operation. However, many of these parameters cannot be specifically determined. For this reason, models must be studied in a way dependent on the uncertainty of the unknown parameters. This was previously difficult to achieve with normal calculations because thousands or even millions of individual calculations had to be carried out. This process can be greatly accelerated using the machine learning approach. To create a machine learning model, a two- to three-digit number of training data is sufficient and once it has been calculated, the model can be analysed within milliseconds. This speeds up the analysis of the different result distributions by several orders of magnitude. "A machine learning model calculates so quickly that we can basically view it as a container of ready-to-use calculation results, like a database," says Jan Hansen. ■