

PAPER TITLE

Projecting 3D-Stereo Imagery in a Fixed-Base Driving Simulator

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ABSTRACT

(500 words max)

Daimler Research & Development has more than 30 years of experience in full-task driving simulation. Daimler currently operates several different driving simulators in their Driving Simulator Center in Sindelfingen, Germany. The configuration of these simulators range from several fixed-base simulators without any motion and only one out-of-the-window visual front channel, up to a high-fidelity, full motion simulator with an eight channel 360° horizontal field of view visual system. All these simulators are used for investigations in the field of driving dynamics as well as the development of driver assistance systems. Each simulator is equipped with a projection system to present the out-of-the-window-view to the driver.

In order to present more depth cues to the driver, one of the fixed base simulators has now been equipped with a 3D-stereo projection system for a 220° front view projection with 5 visual channels. A passive stereo approach has been chosen with one projector per eye for each channel, in order to realize an image projection without any flicker, as it might result from switching between the left and right images for an active stereo installation. The INFITEC filter method is used for the left/right signal masking. This technology is based upon a wavelength multiplex process, which divides the visible light spectrum into different wavelength ranges using steep-edged optical filters. Some of these wavelength ranges are presented to the left eye, whilst the others are presented to the right eye through the dedicated projectors. By an appropriate design of the transmission spectra of the filters, it can be ensured that both eyes are reached by wavelengths in the red, green, and blue range of the visible light, so both eyes can see a fully colored image with only minor color shifts. The wavelength multiplex technology requires filters for the projectors as well as for the glasses the driver has to wear.

These glasses are lightweight and do not include any active devices, as they are integrated for example into the more common shutter glasses. INFITEC also does not need any synchronization between the glasses and the projected imagery, leading to a very robust and steady 3D stereo effect. By wearing INFITEC filter glasses the driver can still see and read all displays, that are not included in the INFITEC filtering, like car instruments, navigational monitors or the side mirrors, realized with flat LCD-displays in Daimler's driving simulator cabins.

Based upon a brief introduction of the fundamentals of the human's depth perception and 3D stereo vision, the paper will describe Daimler's 3D stereo projection system in all details. This description will include the mechanical as well as the optical installation and the integration into the simulator setup with its real 3D car cabins and a virtual 3D visual database. It will also explain the initial alignment of the system, followed by the details of the specific 3D stereo setup, which has been evolved in order to support a highly realistic 3D visual impression for the simulator driver.

BIO

Hannsjoerg Schmieder, Daimler AG, Research & Development

PRIMARY AUTHOR

(250 words max)

Hannsjoerg Schmieder works as the Manager for Visual Systems at the Daimler Driving Simulator Center in Sindelfingen, Germany. He joined the Daimler simulation team in 1986, and since then he has been in charge of all simulator visual systems, including the image generator hard- and software, the projection and display systems as well as the visual databases. Throughout his more than 30 years in the driving simulation business Schmieder also designed, prepared and ran many driving simulator experiments, and he has been involved in several major system upgrades. His primary interest has always been focused on the further development of the visual system's technology in simulation. Besides working for Daimler, Schmieder used to teach Computer Architecture, Computer Graphics and Computer Science classes at the University of Applied Sciences in Berlin for almost 20 years. Prior to his work for Daimler he has been a member of the Computer Graphics Research Group at Technical University Berlin for several years. Hannsjoerg Schmieder holds a Diploma in Electrical Engineering and Technical Acoustics from Technical University Berlin. He is the father of 3 adult children and likes to spend as much time as possible with his grandson, to travel with his wife, to take pictures on these trips and to play drums.

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