Simulating the acoustics of truck-driving

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Abstract

The goal of our project was to develop a computer programme for real-time acoustic simulation of the noise in an operating truck. Our approach was twofold. First, we recorded sounds and noise via a microphone in a truck, running under various conditions in the real world (i.e. different driving speeds, engine revolutions while driving or during a standstill, furthermore the wind and wheel noise of the moving truck without working engine). The recorded noises were analysed using Fast Fourier Transformation to get the power spectrum in steps of third octaves. From these data we extracted the relevant elements constituting the vehicle noise under various conditions. Second, we developed a noise model based on the relevant physical parameters of a truck in action. The empirical findings and the model with its parameters were combined and programmed to run on the sound machine of a Silicon Graphics workstation. The sound impression of different developmental versions of the programme were evaluated with respect to the noise impression in the reality. The result of the project is that the physically perfect noise model did not produce the best impression. Instead, adding some random noise lead to a much more realistic impression.

Introduction

Improving the visual aspects of a virtual reality is only one step to enhance simulator validity. It is also important to supply the appropriate acoustic stimuli to the driver.

Our own experimental experience and the reports of drivers using different driving simulators suggest that good acoustics are possibly a more important item for high-fidelity simulation than high sophisticated textured surfaces of the visual image. In some simulator experiments, we work with reduced visibility (i.e. fog or night rides). The majority of our test persons reported, that the reduction of the visibility does not reduce their impression of the reality of the scene. But when we switch off the acoustic component of the simulation, they stopped having the impression of driving and reported feelings like flying low above the ground (Popp, unpublished).

One way to achieve the power of an immerse (or valid) impression of a simulation is to try to get a perfect copy of the world that has to be simulated. The question how to be more realistic is quoted only in a pure physically sense. To improve the acoustic impression in that way is to sample all thinkable probes of the