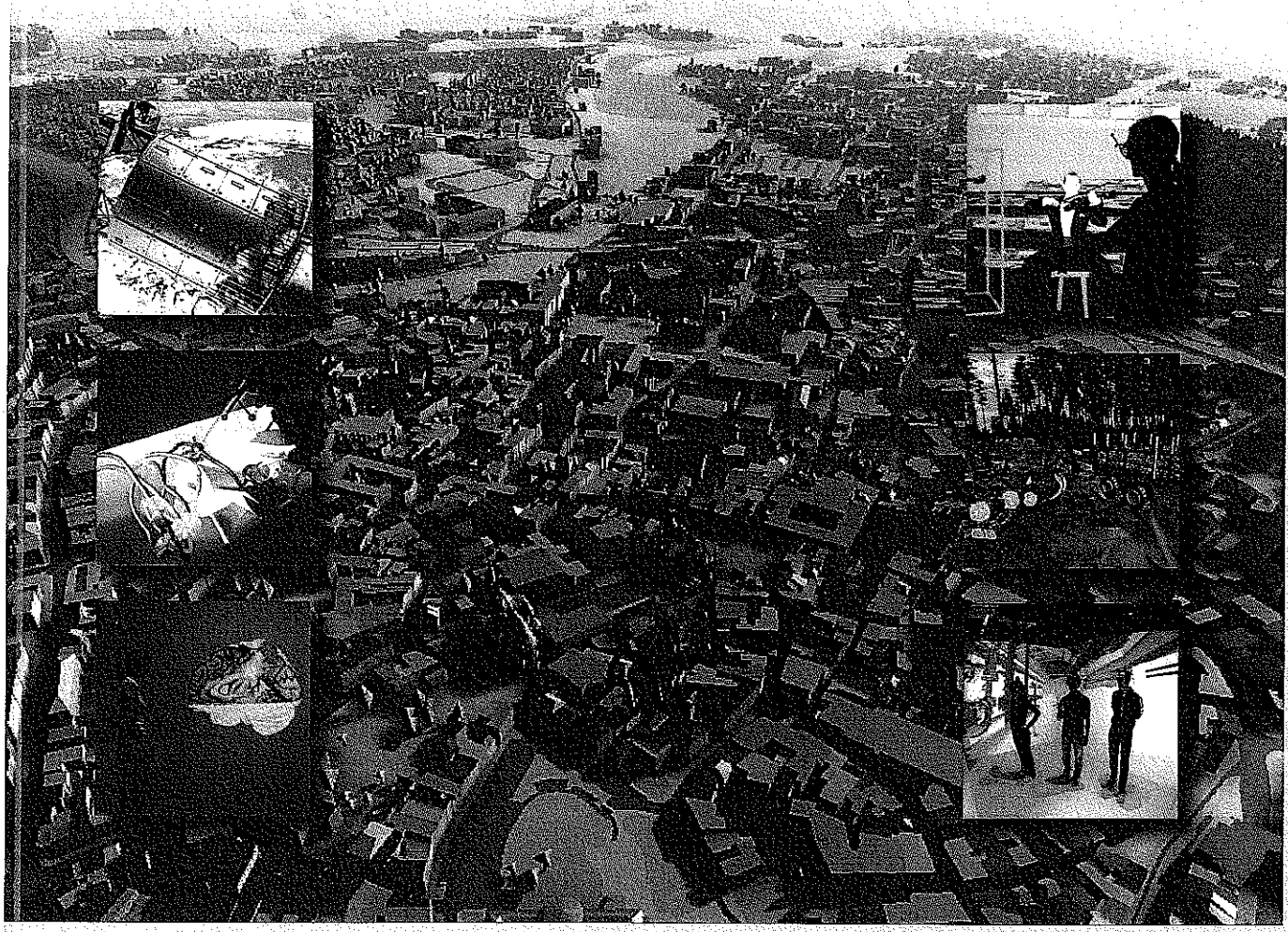
VRCA VIRTUAL REALITY CENTER AACHEN



Progress Report
Volume 4

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RWTH AACHEN UNIVERSITY

Computational Engineering Science – Applications

Electromagnetic Field Solution

Partners:

- Institut für Elektrische Maschinen, RWTH Aachen University
- Virtual Reality Group, RWTH Aachen University

Nowadays the design process of electrical machines and actuators is more and more accomplished virtually by using numeric simulation techniques. Due to the strong increasing computational power of recent years, virtual prototyping has gained interest for the design of electrical machines. Therefore the finite element method (FEM) is applied to several physical domains, such as electromagnetic, structure-dynamic, thermal and acoustics, to determine machine characteristics. The outcome of this is a large amount of solution data that needs to be analyzed and understood. Virtual Reality (VR) environments are suited to achieve these demands. VR can be used to present research results and large and probably confusing data sets to no experienced persons, providing them an insight into research objectives. A post-processing software has been developed, utilizing the open source Visualization Toolkit VTK to display results of Finite Element simulations. The interlinkage to Virtual Reality is realized by VISTA [cf 27], providing the interface to graphics hardware and projection systems.

The finite element method is a general technique for computing solutions of a partial differential equation for arbitrary field problems on a given discretized geometry.

Adding problem dependent boundary conditions, FE computations simulate complex, time varying, processes and generate a large amount of solution data that needs to be analyzed and understood. For this purpose VR representations and corresponding data processing methods are suited.

In the past, the Institute of Electrical Machines (IEM) from RWTH Aachen University developed the software tool iMOOSE.trinity to visualize such results. Recent modifications and improvements are actually implemented in the tool enhancement iMOOSE.trinity.vr.

Both software packages can be interlinked with the toolkit VISTA, a platform for VR technology and interactive 3-D visualization, developed by the Center for Computing and Communication from RWTH Aachen University.

This enables, that all simulation results of the IEM can directly be imported by VISTA and processed on its compatible hardware and VR projection systems.

Common library of both systems is the open source Visualization Toolkit (VTK), which offers various methods for virtual reality visualizations.

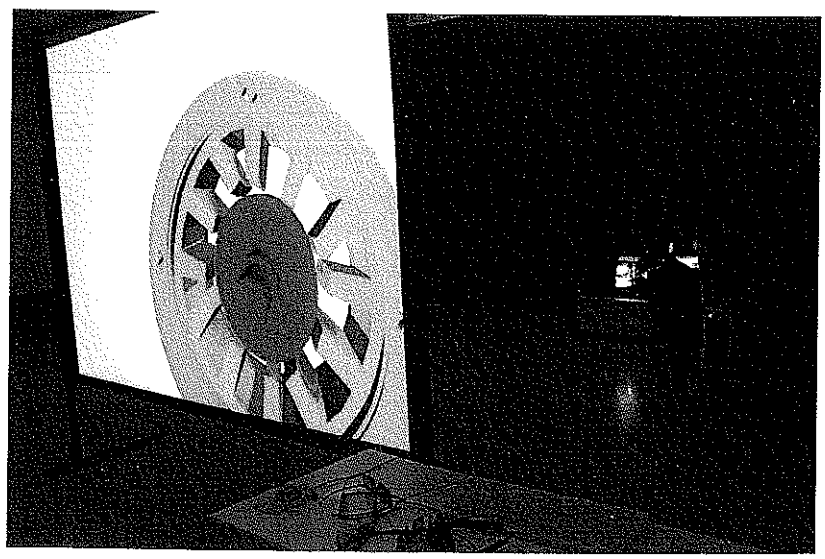

Figure 1: Mobile projectionssystem at COMPUMAG 2007

In 2007 the tool chaining of Trinity and VISTA had been used to present latest research topics of the IEM at the Conference on the Computation of Electromagnetics (COMPUMAG 2007), held in Aachen.

On a mobile VR System, consisting of a rear projection system and interaction devices (see figure 1), the transient flux density distribution of a claw pole alternator and the deformation of a switched reluctance machine were displayed. Moreover, the conference attendees were invited to visit the Cave (see figure 2), located in the Center for Computing and Communication, to explore further machine models in an immersive environment.

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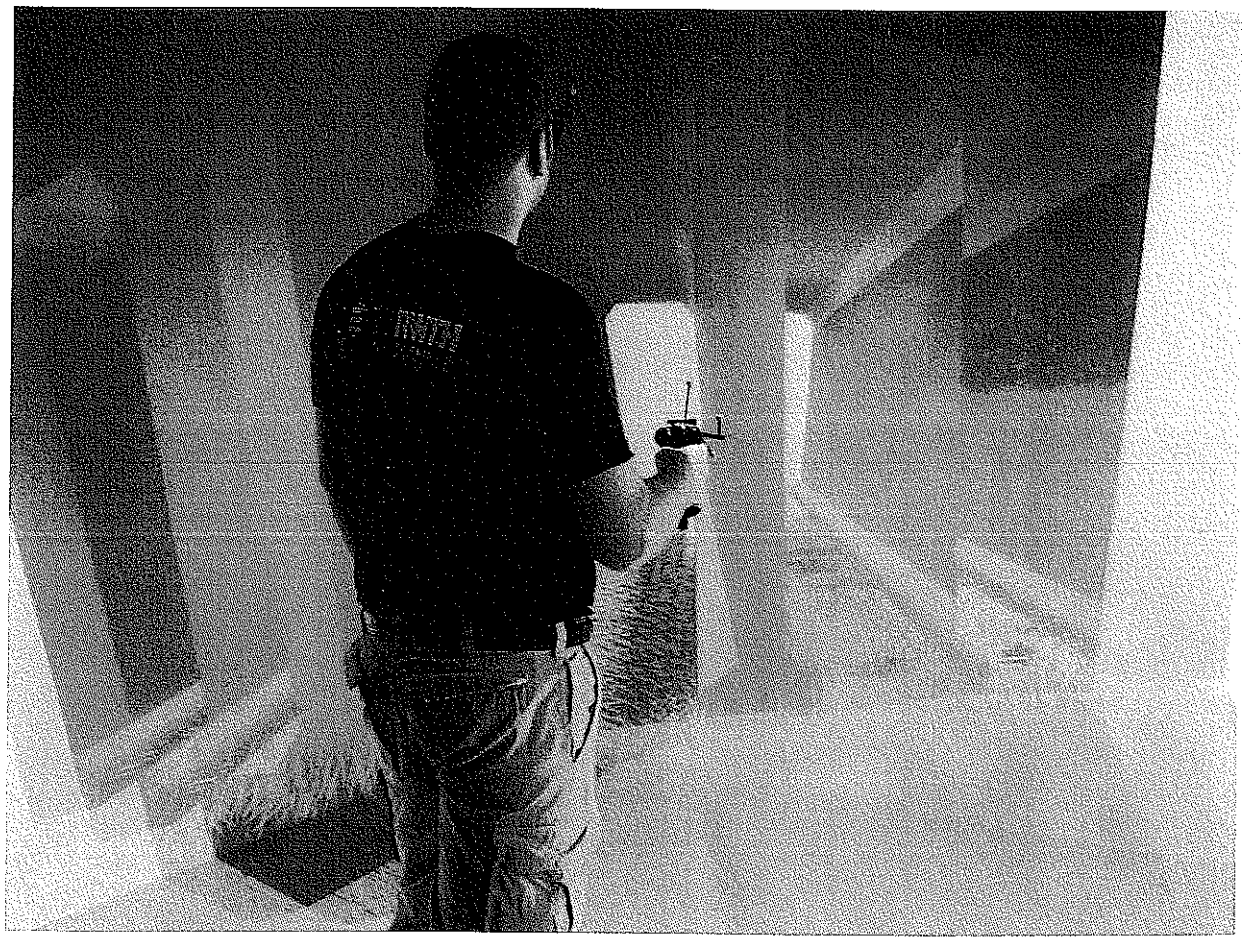

Figure 2: Exploration of electromagnetically Simulation Data in a Cave