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COMPUTATIONAL STEERING: TOWARDS ADVANCED INTERACTIVE HIGH PERFORMANCE COMPUTING IN ENGINEERING SCIENCES

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ABSTRACT

Key-words: *Computational steering, high-performance computing, interactive simulation, virtual reality, CFD*

Computational Science and Engineering faces a continuous increase of speed of computers and availability of very fast networks. Yet, it seems that some opportunities offered by these ongoing developments are only used to a fraction for numerical simulation. Moreover, despite new possibilities from computer visualization, virtual or augmented reality and collaboration models, most available engineering software still follows the classical way of a strict separation of preprocessing, computing and postprocessing. This paper will first identify some of the major obstructions of an interactive computation for complex simulation tasks in engineering sciences. These are especially found in traditional software structures, in the definition of geometric models and boundary conditions and in the often still very tedious work of generating computational meshes. It then presents a generic approach for *collaborative computational steering*, where pre- and postprocessing is integrated with high performance computing and which supports cooperation of workgroups being connected via the internet. Suitable numerical methods being at the core of this approach like the Lattice Boltzmann method for fluid dynamics and the newly developed Finite Cell Method for structural mechanics are briefly discussed. Several model scenarios are demonstrated, including an indoor airflow simulation for a complex surgery room, where geometric objects are interactively modified and where the simulated flow field reacts ‘on-the-fly’ (Fig.1).

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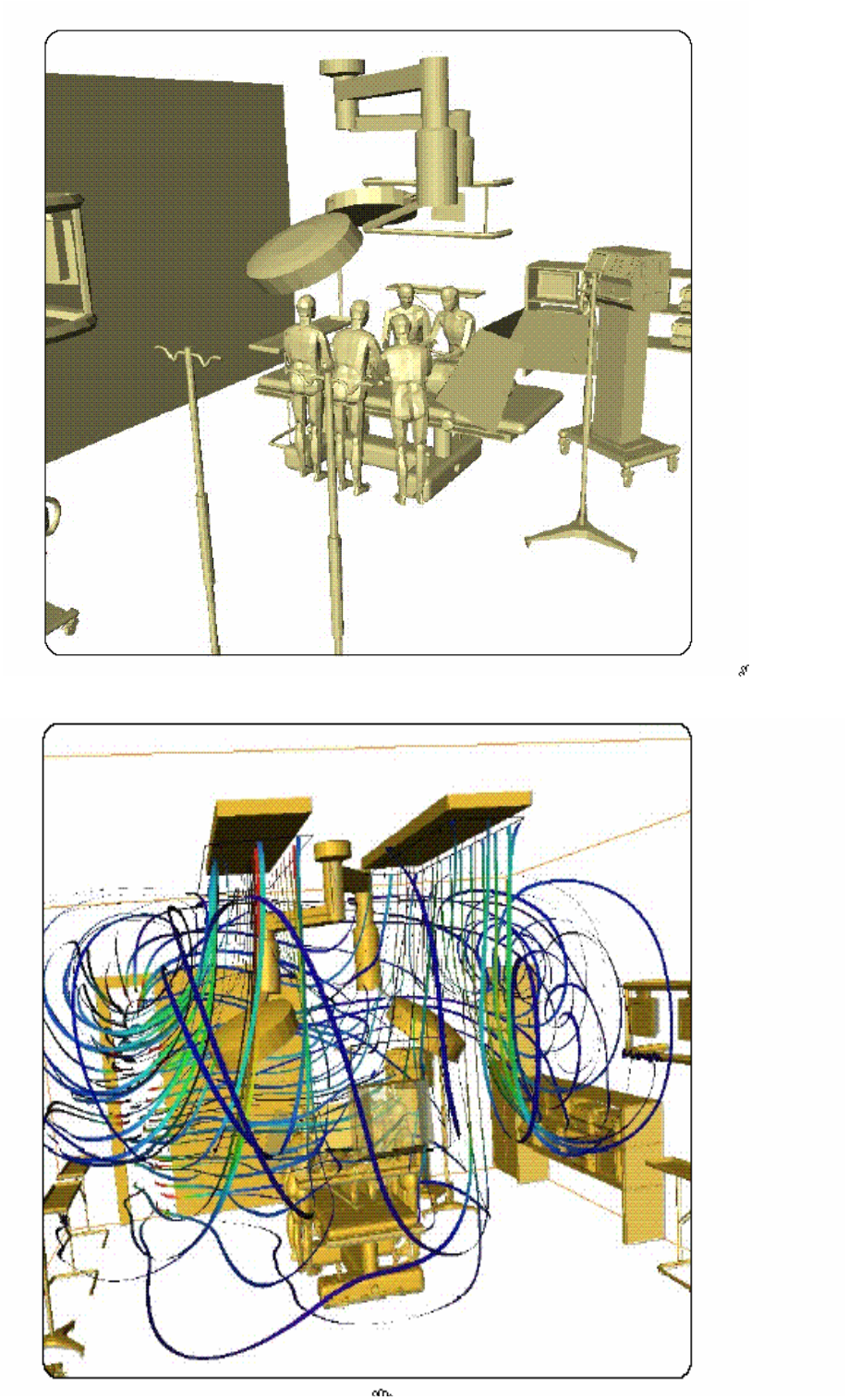

Figure 1: Geometric model of a surgery room and screenshot of an interactive CFD simulation