Interactive CFD Simulation by Coupling Supercomputers with Virtual Reality

Abstract:
Computational Fluid Dynamics (CFD) simulations in a Virtual Reality (VR) environment allow a very flexible analysis of complex flow phenomena, supporting the planning process of a building with respect to fluid mechanical aspects. In this paper a prototype application of a CFD-based computational steering system is presented. Simple geometries can be modified interactively in a Virtual Reality system consisting of a stereoscopic projection unit and a wand device and are sent to a high performance supercomputer. The underlying CFD simulation is performed by a Lattice-Boltzmann kernel, which shows excellent parallel efficiency. State-of-the-art visualization techniques allow for an intuitive investigation of the transient nature of the corresponding flow field. The area of application primarily covers the analysis of indoor air flow and the optimization of Heat Ventilation Air Conditioning (HVAC) systems.

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