

Visualization of Simulation Results Based on Mobile Augmented Reality

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Introduction

This paper describes a method of visualizing fluid analysis simulation results based on AR technology. Indoor flow and contaminant convection-diffusion analysis is performed using the analysis results of commercial solvers such as OpenFOAM and Fluent, which are the most widely used CFD open source solvers. The analysis results are realistically visualized on mobile devices using AR technology, and a cloud computing environment is used for real-time visualization. In other words, the cloud computing environment is used to process the CFD simulation results and environmental tracking in AR environment which require large computing resources.

Related Works

• W. Li et al. (2017): AR-based visualization helps users recognize and understand the analysis results more accurately by visualizing and representing numerical analysis results in a real physical space. Users can verify in real time the parameters that influence products and technologies and efficiently analyze problems by updating numerical analysis results in real time in the real world. Therefore, AR can be used as the best tool for engineering analysis and simulation.

• T. Tawara and K. Ono (2010): AR technology has been studied in various engineering simulations. In the biomedical field, the visualization of Computed Tomography (CT) and Magnetic Resonance Imaging (MRI) data in AR has been mainly researched.

• D. Widlich et al. (2008) etc.: In the machinery and manufacturing fields, studies have been conducted on AR visualization of 3D shape models and structural analysis results for intuitive examination and discussion of 3D design data such as Computer-Aided Design (CAD)

Design of the Mobile AR Post-Processor

The concept of the mobile AR-based CFD simulation post-processor is as shown below.



Optimization of the CFD Results

In the CFD analysis result, the space in which fluids move has a very large number of elements because it is represented as a form with surface data and filled inside. Therefore, for effective visualization of the CFD analysis result in a mobile environment, the visualization elements extracted from the analysis result need to be lightweight.



Generation Visualization Data

The elements produced in each process are rendered through the Unity Rendering Pipeline.



Conclusion

In this paper, we proposed a CFD simulation postprocessor using mobile AR technology. This method allows users to examine and analyze CFD simulation results in various simulated spaces effectively and immersively. In the future, we plan to apply various types of CFD simulation results besides indoor air cleaner and perform usability tests.