A REAL-TIME MODELLING AND SIMULATION PLATFORM FOR VIRTUAL ENGINEERING DESIGN AND ANALYSIS

Adrian R. G. Harwood[1], Petra Wenisch[2] and Alistair J. Revell[1]

[1]School of Mechanical, Aerospace & Civil Engineering
The University of Manchester, Oxford Road, Manchester, M13 9PL, UK
adrian.harwood@manchester.ac.uk

[2] Univerity of applied Sciences Potsdam, Faculty of Civil Engineering
Kiepenheuerallee 5, 14469 Potsdam, Germany
wenisch@fh-potsdam.de, www.fh-potsdam.de

The ability to perform credible CFD simulations at accelerated speeds has opened up the potential for a new use-mode for CFD as a tool in engineering: the application of CFD for first-order parameter-space exploration, analysis, and design communication. When coupled with a suitable real-time rendering and interaction capability for in-situ visualisation and manipulation of 3D results, CFD may be used as part of an interactive design tool in virtual engineering. These steerable applications represent a paradigm shift in the application of CFD for engineering and offer the potential to transform the way CFD is used within the industry.

This article presents developments towards a production-ready virtual wind tunnel including presentation of an integrated, interactive modelling and simulation tool for aerodynamic design and analysis built using the Unreal Engine 4 game engine. The virtual wind tunnel application provides a mechanism for integrating virtual reality observation, navigation, visualisation and in-game interaction with a flow field simulated using our own GPU-accelerated CFD library based on the lattice-Boltzmann method. Objects may be imported from CAD or reconstructed using Microsoft Kinect-based 3D scanning. Simulation parameters may be modified at run-time by the user.

The flow solver has been validated against experimental data for a representative turbulent flow and demonstrates excellent agreement with available data.