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THE DETAILS OF CFD DO MATTER

Harry E.A. VAN DEN AKKER

Dept. of Multi Scale Physics, Delft University of Technology,Delft, Netherlands

ABSTRACT

Computational Fluid Dynamics (CFD) has become a workhorse in and for the process industries. Usually, the term CFD refers to commercial software based on Reynolds Averaged Navier-Stokes (RANS) equations, applying numerical methods of the Finite Volume type, available off-the-shelf and easy to use for chemical engineers. Although this common type of CFD is a huge leap forward in comparison with the traditional concepts of *e.g.* plug flow and CSTR, it also has serious limitations. Much more advanced CFD options are developing such as Large Eddy Simulations (LES) and Direct Numerical Simulations (DNS) which try and avoid modeling as much as possible.

LES are excellently capable of reproducing the turbulent (*i.e.* transient) flow conditions in which chemical and physical processes are carried out and on which their performance depends. DNS of flow and transport phenomena in small representative periodic boxes are perfectly suitable for finding out about the relevant dynamics of the local processes.

First of all, this keynote lecture addresses the main characteristics, results and shortcomings of RANS-based CFD tools. In addition, the more advanced and promising LES and DNS will be reviewed and assessed. Typical examples of LES and DNS results will be presented for a variety of processes.

Throughout the presentation, substantial attention is paid to the attractiveness and success of exploiting Lattice-Boltzmann techniques, rather than Finite Volume techniques, for the more advanced CFD approaches.

REFERENCE

Harry E.A. Van den Akker, 2006, *The Details of Turbulent Mixing Processes and their Simulation*, Advances in Chemical Engineering, Vol. 31, Elsevier, pp. 151-229