

Advanced Techniques in Computational Flow Visualization

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Abstract

Today's CFD workflows typically focus on the meshing and solving stages. As a consequence, the visualization stage cannot catch up with the complexity and variety of the simulation results. On the one hand this slows down research and development in the application domains and the CFD workflow itself, on the other hand it can prevent important discoveries and insights.

Over the last two decades, research in computational visualization has emerged into a competitive discipline at the interface between scientific computing and computer graphics. Its ultimate goal "seeing the unseen" has been pursued in many application domains and in particular in CFD where straightforward depiction is often insufficient. We will exemplify the potential of advanced flow visualization techniques to analyze vortical flow, to reveal the structure of transport in time-dependent vector fields, and to accurately visualize CFD results given in higher-order representation. However, while computational flow visualization is a success story in research, the application domain stays behind. A possible way to a more holistic CFD workflow could be through commercial simulation codes: most of them feature a post-processing stage and it could be in the interest of these companies and their customers to ease the overall CFD procedure by including more advanced flow visualization techniques.