Summarization and exploration as paradigms for visualizing large DNS results

Chandra Kambhamettu
University of Delaware

With the advent of petascale computing, there has been an explosion of data from numerical simulations. Though visualization systems are capable of utilizing parallelization and compression techniques to handle this, rendering techniques which automatically illustrate a specific phenomena hidden within larger simulation results are still nascent. In fluid dynamics and turbulence studies, fluid properties are volumetric in nature and cannot be displayed in their entirety. Identifying sections of the result which contain typical and atypical phenomena offers a convenient way of analyzing such data. The novel aspects of our visualization framework are that the user interaction does not depend on the knowledge of domain specific parameters and rendering does not involve multipass processing of the data. We present our results on the development of a two pronged approach for the analysis of DNS results – a summarization scheme that presents an overall picture of the interactions between flow structures and droplets, and an exploration scheme to query for interesting interactions. Fast and efficient computation of collisions between flow structures and droplets can be used to generate and study interaction patterns. For the exploratory phase, we use volume feature descriptors together with droplet trajectories to classify the interactions of fluid structures and droplets.