A QUICK AND FEATURE BASED VISUALIZATION ALGORITHM FOR LARGE-SCALE FLOW DATA

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1. ABSTRACT

Ocean is a basic part in the global living system with rich resources, it also has important strategic situation in the world. There is a pressing need to improve the management of ocean and its ecological environment with Geometry Information System that can help people to make use of ocean information effectively. However, it requires researchers to better understand the oceanic elements and their ongoing processes, most of them hiding in a great amount of numerical data. One effective approach is to use flow visualization to transform the oceanic data into graphical images, which greatly enhances the ability of processing ocean information and recognizing the under patterns of natural phenomenon. There are many techniques have been presented in the last decade [1, 2], but few of them can get high performance to visualize large-scale flow data in real time. To deduce the computational complexity brought by the massive flow dataset, feature-based expression will be a helpful way. However, how to get the graphical images quickly and effectively without costing much time for feature extraction and analysis is still a challenging one.

To get global flow pattern with emphasizing interesting areas in real time, a fast and feature based method was proposed in this paper. Though there are some techniques based on feature expression were presented in these years[3, 4], they are not appropriate in real time applications, because of needing a large number of computations to deal with feature localization and feature defining, especially in large and complex flow situations. Based on the common characteristic of flow and the unchangeable scale feather of spiral line, we present a new distributing strategy which needn't locate feature points very accurately and didn't rely on the type of feature fields. The visualization procedure not only can straight forward automatically but also can be adjusted with user's interactive command. First, we localize critical points cursorily, and segment the whole flow field into several regions with the consideration of vectors' influence, each containing a single critical point. Next, the key parameters of spiral line must be calculated according to the size of each region. In the vicinity of points, the seeds are distributed with the spiral strategy, and the streamlines traced from these seeds bring out the nature of the flow around the feature points， that maybe the most interesting one for the user. At last, to deal with the "blank" spaces leaved in the field, an appending grid for priority selection strategy is used which helps to place streamlines in the non-critical regions so that the overall presentation is aesthetically pleasing. The dynamic control of distributing and lengths of stream lines given in the strategy can adjust the result to the users' command flexibly. This method is both effective in 2D and 3D fields. The flow data obtained from the South Sea of China was verified and simulated. The result shows that this method using spiral strategy not templates to setting the seeds to emphasize the interesting fields is much faster and flexible, especially in large-scale flow data visualization.

2. REFERENCES

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