ALGORITHM OF FLOWFIELD VISUALIZATION BY VECTOR GRAPHICS

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KEYWORDS:
Main subjects: algorithm, flowfiled visualization
Fluid: scalar flowfield
Visualization method(s): vector graphics
Other keywords: small file size

ABSTRACT: The progress in computer performance and memory promoted an increase in the computational grid size. Modern grids sometimes contain hundreds of millions or even billions of cells. The most important phenomena often occur within several neighboring cells; therefore, it is important to provide a high resolution of the image during field visualization to capture these important phenomena. On the other hand, the resolution of various devices for printing images on paper is permanently improved, which allows detailed images to be published in journals or books. This procedure also requires high-resolution initial images.

If raster graphics is used, the resolution is improved by increasing the number of pixels. If a smooth change in the scalar quantity between two neighboring cells is needed, it is necessary to have several pixels in each cell. Correspondingly, the number of pixels in large-size cells can reach tens of millions. Even if rather effective compression algorithms (PNG, JPG) are used, the file size often reaches several megabytes. Files with books, reports, or papers containing a large number of such illustrations are so huge that it is difficult to send them by e-mail, read on the monitor, and especially to print them, because the velocity of data transmission to printers does not grow so rapidly as the processor speed

The use of vector graphics allows storage of high-quality images, which can be easily scales without resolution deterioration. In most cases, visualization programs consider each cell of the computational domain separately. With the use of vector graphics, the image in each cell is formed by one or several primitives. For each primitive, it is necessary to store at least its type and a set of its coordinates. For grids with millions of cells, therefore, huge files multiply exceeding the pixel image size are obtained.

An algorithm is proposed, which allows a high-quality scalable image of scalar fields to be stored in a file of a comparatively small size in the PostScript language format or any other format supporting vector graphics.

For instance, Fig. 1 show the distributions of pressure and Mach numbers obtained in studying the viscous structure of the flow in the case of the Mach reflection of the shock wave from the plane of symmetry for the flow Mach number M=4 [1]. The size of the computational domain was 1600 x 800 (1.28 million) cells. The sizes of the files with the image constructed for 250 levels in the PostScript format are 121 Kb and 88 Kb, respectively .High resolution PNG format files have 267 Kb and 196 Kb, respectively.

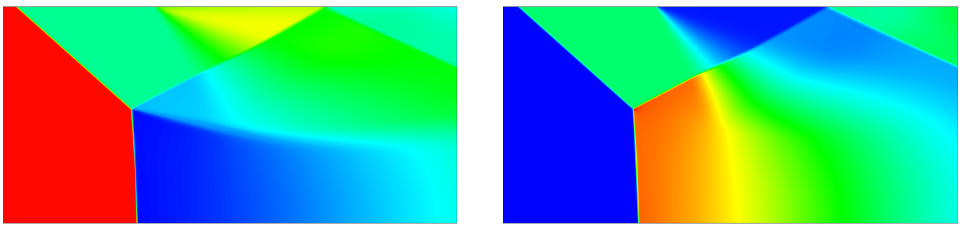

Fig. 1 Pressure (left) and Mach number (right) in EPS format

References

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