A Volume PTV

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The purpose of the study is to construct a new 3D-PTV algorithm (a Volume PTV) based upon a hybrid fitness function. In the algorithm, a coherency fitness function is also introduced beyond space and time. The developed algorithm has been employed to probe the turbulence properties of the cylinder wake. Fig. 1 shows the experimental setup for the experiments. The measurement system consists of two-high-definition-cameras(1k x 1k), a Nd-Yag laser and a host computer. The Reynolds numbers with the cylinder diameter (d=10mm) are 360, 540, 720, 900, 1080 and 1260. Fig. 2 shows a hybrid fitness function. This function was used to sort out the correct particle pairs between the two camera images. Before employing this function, two-dimensional displacements of the particles of each camera's images have been utilized to reduce the calculation loads. Fig. 3 shows the constraints (PN and PM) for reducing the calculation loads. More than 10,000 instantaneous 3D vectors have been obtained by the constructed algorithm. The constructed algorithm could recover more than 80~90% of the particle numbers in the experimental images. The optimal parameters in the algorithm were PM[particle movements] =8 pixels, PN[particle neighborhood] =5mm. Fig. 4 shows the primary vortex structure when the Reynolds number is 360. The structures of the wake and the turbulence properties will have been quantified in detail from the results obtained by the constructed system.

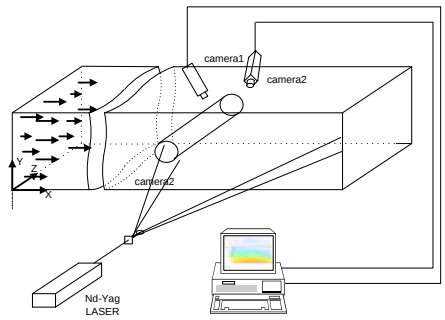

Fig. 1 Experimental setup.

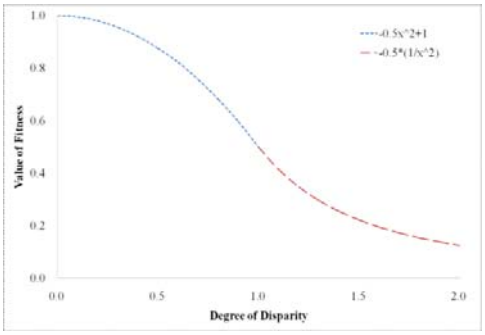

Fig. 2 Hybrid fitness function for sorting the particle pairs.

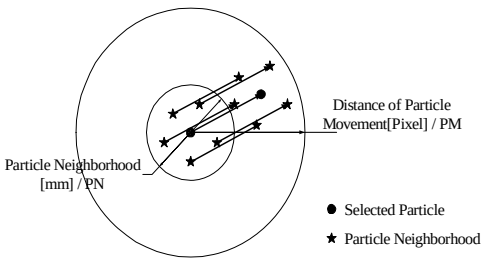

Fig. 3 The particle neighborhood[PN] and the distance

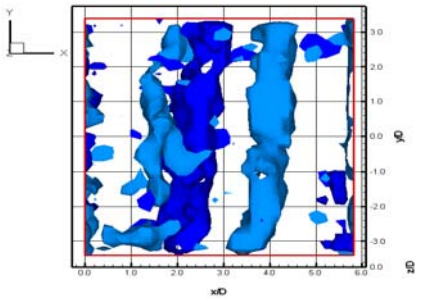

Fig. 4 **Primary vortex structure at Re=360.**