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Wake Structure of Bubbly Flows around Various Types of Objects

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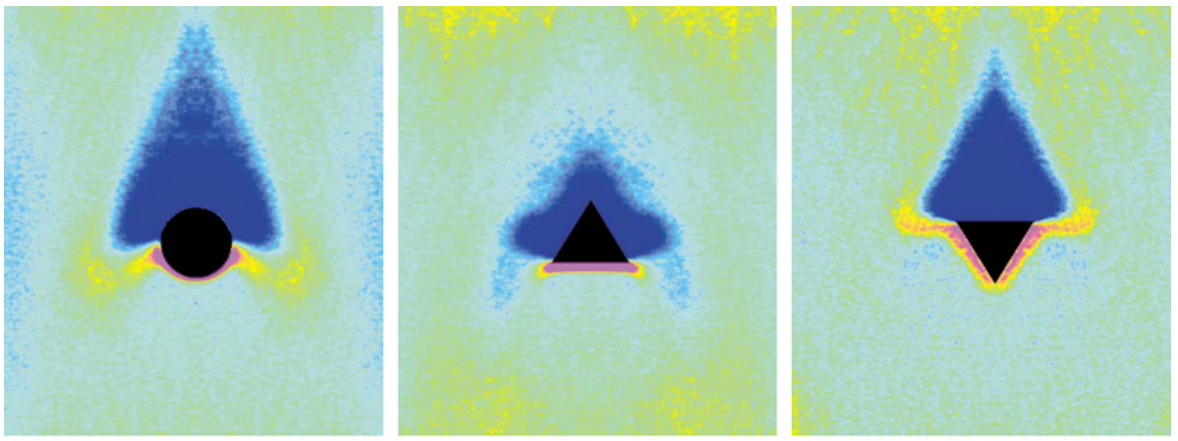

(a) Circular cylinder

(b) Triangular cylinder (Plane-counter)

(c) Triangular cylinder (Edge-counter)

(d) Square cylinder (Plane-counter)

(e) Square cylinder (Edge-counter)

Local void fraction distribution due to various shapes of objects.
Void fraction $\alpha = 0.074$, Bubble radius $r_g = 1.76$ mm.

When a solid object is put in a free-rising bubble flow, a large convection is induced around the object. The convection scale is much greater than the length scale of the object, which is never seen in incompressible single-phase flow. This phenomenon is clearly observed when the bubbly flow is formed in a small channel and has equaled bubble size as well as spatially uniform void fraction in the upstream of the object. Detailed specification is as follows. Coaxial twin rectangular chamber made of transparent acrylic resin is used, which is 500 mm in width and 1000 mm in height. The channel depth is 10 mm. 376 bubble injection nozzles with ID of 0.3 mm are installed on all four channels. Room temperature air is supplied from the compressor through a high accuracy pressure controller and flow meter. A back lighting method through an irradiating metal halide lamp (250w$\times$two), which is set in the central cavity of the chamber is adopted in order to get the bubble shadow image. An optical diffusion sheet is also supplemented. A flow field of 0.50 m$\times$0.50 m surrounding the object is recorded by a digital video camera. The pictures show the local void fraction distribution in the case that void fraction $\alpha = 0.074$ and bubble radius $r_g = 1.76$ mm.