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Experimental study on a three-dimensional riblet with particle image velocimetry HIDEYUKI MIKI, KAORU IWAMOTO, AKIRA MURATA, Tokyo University of Agriculture and Technology — Experimental study on a new three-dimensional (3-D) blade riblet is carried out in a two-dimensional channel. The lateral spacing of our 3-D riblet surface is periodically changed in the streamwise direction. The flow structure over the 3-D riblet was analyzed in the turbulent flow field by using 2-D Particle Image Velocimetry (PIV) on a vertical $(x-y)$ and a horizontal $(x-z)$ plane. The turbulence statistics were compared with the corresponding flow over the flat surface in an attempt to identify the drag-reduction mechanism. Under a drag-reducing condition, the mean velocity profile showed upward shift in the log-law region. The streamwise, spanwise velocity fluctuations and the Reynolds shear stress were decreased, whereas the wall-normal velocity fluctuation was increased. The quadrant analysis of the Reynolds shear stress provides detailed information on the contributions to the total turbulence production from various events occurring in the flows. The 3-D riblets intensified the Reynolds shear stress producing event (second and forth quadrants). On the other hand, it was interesting to note that the first (outward) and third (inward) quadrants are dramatically increased compared with the smooth surface, leading to the drag-reducing effect.

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