

EFFECTS OF RELAXATION TIME OF POLYMER SOLUTIONS ON THE SPATIO-TEMPORAL FLUCTUATION IN A TWO-DIMENSIONAL FLOW

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ABSTRACT

Addition of a small amount of polymer or micelle-forming surfactants to a fluid reduces frictional drag and delays the transition to turbulent flow. Main feature of this phenomena is that the extensional flow induces extension of polymers, and the extended polymers affect coherent structure of the fluids such as vortices in the flow. Therefore, we have been working on flowing soap films as a two-dimensional (2D) turbulent flow where the extensional stress mainly affects the flow to observe the effects of extensional rheological properties of the fluids on the vortex shedding in the 2D flow^{1,2}. We have found the deformation of vortices, and the modification of energy transfer in polymer doped 2D flow¹. Furthermore, the deformation of vortices may be caused as a result of elastic instability in the flow. In this study, we calculated spatio-temporal correlation of velocity fluctuations and the turbulent energy in 2D turbulent flow. The addition of polymers makes differences between the temporal correlation and the spatial correlation converted by the mean local velocities in the streamwise direction. The delay between the temporal correlation function and the spatial correlation function seemed to be affected by the relaxation time of the solution.

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