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Energetic analysis on a turbulent channel flow with spatial blowing/suction perturbation

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Flow control is one of the major topics in fluid mechanics aimed at altering unnatural flow state into a more desired state. Since most engineering flows include complex conditions, emphasis has been put on development of active controls in recent decades, Gad-el-Hak (2007). One of the well-known active control techniques is blowing/suction perturbations, which is used experimentally or numerically by many investigators. A detailed numerical analysis of the influence of steady and unsteady blowing/suction over span wise slots on the velocity and thermal fields in a turbulent channel is introduced by Araya et al. (2008, 2011). They concluded that intensification in the wall shear stress fluctuations was the major cause of skin friction, wall heat flux, and Stanton number augmentation downstream from the local forcing source. In this study, we are using extensive and highly accurate DNS to elucidate the effects of blowing and suction over spanwise holes on the drag reduction and heat transfer coefficient at Re = 394 based on the friction velocity. In addition, the corresponding influence of perturbing amplitudes and angles on the energy budget of velocity fluctuations, thermal fluctuations and mean vorticity are discussed extensively. Furthermore, proper orthogonal decomposition (POD) of the channel flow is analyzed in this study and the energy redistribution of POD modes by the effects of blowing/suction perturbations are shown.

Biography

Xin Can Liu is about to finish his master in December and will continue his Ph.D. in Mechanical Engineering, Texas Tech University (TTU), Lubbock, TX. He received his Bachelor degree in 2011 from Mechanical Engineering, China University of Geosciences, Beijing, China. His research interests are computational fluid dynamics (CFD), turbulence, fluid dynamics and wind energy.

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