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Turbulent pipe flows subjected to temporal decelerations[1] WONGWAN JEONG, HYUNGJAE LIM, JAE HWA LEE, Ulsan Natl Inst of Sci Tech — Direct numerical simulations of temporally decelerating turbulent pipe flows were performed to examine effects of temporal decelerations on turbulence. The simulations were started with a fully developed turbulent pipe flow at a Reynolds number, Re_D=24380, based on the pipe radius (R) and the laminar centerline velocity (U_{c0}). Three different temporal decelerations were imposed to the initial flow with f=$|dU_b/dt|$=0.00127, 0.00625 and 0.025, where U_b is the bulk mean velocity. Comparison of Reynolds stresses and turbulent production terms with those for steady flow at a similar Reynolds number showed that turbulence is highly intensified with increasing f due to delay effects. Furthermore, inspection of the Reynolds shear stress profiles showed that strong second- and fourth-quadrant Reynolds shear stresses are greatly increased, while first- and third-quadrant components are also increased. Decomposition of streamwise Reynolds normal stress with streamwise cutoff wavelength (λ_x) $1R$ revealed that the turbulence delay is dominantly originated from delay of strong large-scale turbulent structures in the outer layer, although small-scale motions throughout the wall layer adjusted more rapidly to the temporal decelerations.

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Wongwan Jeong
Ulsan Natl Inst of Sci
Tech

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