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Temporally dependent coherent structures: Effects of deterministic wall boundary conditions on quasi-streamwise vortices in drag reduced turbulent pipe flow[1] DANIEL COXE, RONALD ADRIAN, YULIA PEET, Arizona State University — Wall oscillations are an active drag reduction mechanism which imparts a deterministic spanwise boundary layer in a mean streamwise flow. The oscillation takes the form of sinewave in time spanwise velocity boundary which imparts phase dependence on turbulent statistics. We present the estimated conditionally averaged quasi-streamwise vortices about the wall phase optimal ejection event. Vortices are presented as a function of wall normal location and wall phase. Visualized by the square of swirling strength, comparisons to the unperturbed estimated vortices are made. Observations about the effect of spanwise boundary layer on near wall streamwise structures are made. Turbulent Fluctuations are separated from the total estimated field and presented to make distinctions between the linear and non-linear structures of near wall turbulence. We show that drag reduction has the effect of weakening and distorting the average quasi-streamwise vortex in drag reduced turbulent pipe flow.

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