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Numerical study on the largest scales of fully developed turbulent pipe flow by LES MAKOTO TSUBOKURA, The University of Electro-Communications — Large Eddy Simulations of fully developed turbulent pipe flows up to $Re_\tau = 2360$ were conducted using a very long streamwise analysis region, which amounts to a hundred times longer than a pipe radius, to investigate the longest streamwise motions typically observed in the logarithmic layer of wall turbulence. In the previous study we conducted an intensive grid resolution study to properly reproduce outer large-scale structures in plane channels and found that sufficiently fine grid resolutions of around $h_x^+ \sim 30$ and $h_z^+ \sim 20$ for streamwise and spanwise directions in wall coordinate are required in the near wall region. Following this grid resolutions, our new pipe LES were carried out based on the fully conservative finite difference scheme in cylindrical coordinates along with the novel pole treatment developed recently by Morinishi et al. (2003). The structural difference of the obtained large scales between the pipe and the plane channel flows is discussed regarding the universality of the outer large scales, and the k^{-1} spectrum of the streamwise velocity in the context of self-similar structure having been reported in experimental measurements of pipe flows will also be mentioned.

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