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Interfacial phenomena in turbulent magnetohydrodynamic channel flows at low magnetic Reynolds number NAOYA OKAMOTO, YUSUKE OTAKE, TAKASHI ISHIHARA, Nagoya University — Direct numerical simulations (DNS) are performed to examine whether interfacial phenomena can be observed in magnetohydrodynamic (MHD) turbulent channel flows under the influence of imposed magnetic field. The magnetic Reynolds number is assumed to be sufficiently low such that the quasi-static approximation can be applied. For high Hartmann number, the visualization of the vorticity field reveals flow structures consisting of turbulent boundary layers (TBL) near the walls and a quiescent channel core. The statistical analysis of the DNS data shows that physical quantities, such as the spanwise vorticity and streamwise velocity, possess sharp gradients at the edges of the TBL. The features of the sharp gradients are qualitatively similar to those of the turbulent/non-turbulent interfaces which have been observed in hydrodynamic turbulent shear flows, e.g. turbulent boundary layers, wakes and jets. The Joule dissipation rate, which is a characteristic quantity in MHD flow, is shown to have sharp gradients at the edges of the TBL. The average height of the edges is theoretically estimated and the estimation is assessed using the DNS results.

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