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Turbulent transfer and secondary flow patterns in transitional MHD duct flows under the non-uniform magnetic field HIROMICHI KOBAYASHI, Keio University, YOSHIHIRO OKUNO, Tokyo Institute of Technology — Large-eddy simulation (LES) of transitional turbulent duct flows is carried out in a liquid metal MHD power generator, and the influence of the non-uniform magnetic field on the turbulent flows is examined. As increasing the magnetic flux density (or Hartmann number), the turbulence is suppressed downstream of electrodes. The higher Hartmann number modulates the mean velocity profile to the M-shaped velocity one (the so-called sidewall jet) in the plane parallel to the external magnetic field. The velocity profiles are modulated more strongly with the magnetic flux density. In the higher Hartmann number, the wall-shear stress in the sidewall layer becomes large and the sidewall jets transit to turbulence. The sidewall jets in the MHD turbulent duct flows have a similar mean velocity profile of the non-MHD wall jets with outer scaling as well as the profiles of Reynolds shear stress with the opposite sign and two maxima for the turbulent intensities in a sidewall jet. The Lorentz force suppresses the vortices of the secondary mean flow near the Hartmann layer for low Hartmann number, whereas the secondary vortices remain near the Hartmann layer for high Hartmann number.

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