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On the stability of a free shear layer affected by a parallel magnetic field[1] ANATOLIY VOROBEV, OLEG ZIKANOV, University of Michigan - Dearborn, UNIVERSITY OF MICHIGAN - DEARBORN TEAM — We investigate the instability and transition to turbulence in a temporally evolving free shear layer of an electrically conducting fluid affected by an imposed parallel magnetic field. The case of low magnetic Reynolds number is considered. It has long been known that the neutral disturbances of the linear problem are three-dimensional at sufficiently strong magnetic fields. We analyze the details of this instability solving the generalized Orr-Sommerfeld equation to determine the wavenumbers, growth rates, and spatial shapes of the eigenmodes. The three-dimensional perturbations are identified as oblique waves and their properties are described. In particular, we find that at high hydrodynamic Reynolds number the effect of the strength of the magnetic field on the fastest growing perturbations is limited to increase of their oblique angle. The vertical and horizontal dimensions and the spatial shape of the waves remain unchanged. The transition to turbulence triggered by the growing oblique waves is investigated in direct numerical simulations. It is shown that initial perturbations in the form of superposition of two symmetric waves are particularly effective in inducing three-dimensionality and turbulence in the flow.

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