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2D kinetic solution describing a non-uniform streaming of a collisionless plasma across a magnetic field

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The 1D kinetic solution for tangential discontinuities is extended to two dimensions by adding a variation of the plasma bulk velocity in the direction parallel to the local magnetic field. The solution of the stationary Vlasov equation is given in terms of two constants of motion and one adiabatic invariant. The partial charge and current densities are given by the moments of the velocity distribution function of each component species. The electromagnetic potentials are found by solving numerically the Maxwell-Ampere equation for the magnetic vector potential and the quasineutrality equation for the electric potential. The gradient (or *shear*) in the direction of the magnetic field of the perpendicular plasma bulk velocity, $\nabla_{||} V_{\perp}$, sustains a parallel (or *magnetic field aligned*) component of the electric field, $E_{parallel}$, that effectively decouples the motion of the plasma and field. We also show that the width of the 2D transition layer depends on the sense of the shear flow on either side of the layer.