Parametric excitation of surface electron cyclotron X- and O-modes by alternating electric fields

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Theory of parametric excitation of the surface electron cyclotron X- and O-modes is developed for the model of uniform plasma confined by an external constant magnetic field oriented along plane boundary of the plasma. The research is carried out using kinetic description for the plasma particles affected both by the constant magnetic field $\vec{B}_0 \parallel z$ and alternating electric field $\vec{E}_0 \cos(\omega_0 t)$. It is assumed that the plasma occupies semi-plane $x \geq 0$, alternating electric field $\vec{E}_0 \perp z$, its frequency is close to the electron cyclotron frequency. Electromagnetic field of these cyclotron modes is described by set of Maxwell equations. It is solved using the Fourier expansion method. Doing that two components of the X- and O-modes’ wave vectors, which are perpendicular to the external magnetic field, have been taken into the account. Nonlinear boundary conditions have been formulated to derive the sets of equations for harmonics of the tangential electric field, which describe the parametric excitation of the both modes. It has been done using the residues theory. Analytical expressions for growth rates of the X- and O-modes’ parametric instabilities have been obtained taking into account three harmonics, namely main harmonic and two nearest satellites. Values of their growth rates are examined analytically and numerically.

[1] Theory