INstability of electrostatic oscillations in rotating cylindrical hall plasmas [[1]](#footnote-1)\*)

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It is well known that plasma immersed in crossed electric E and magnetic B fields is subject to many instabilities [1, 2]. In particular, for sufficiently large electric field, i.e. if the equilibrium angular frequency of E×B plasma rotation is comparable with the ion-cyclotron frequency $ω\_{Bi}$, the two-fluid high-frequency instabilities with $(ω, γ)≳ω\_{Bi}$ ($ω$ and $γ$ are the frequency and growth rate, respectively) can develop in plasma.

In this paper, we consider the problem of stability of axisymmetric electrostatic oscillations of a cylindrical plasma column with a low pressure in axial magnetic and radial electric fields. In the framework of the two-fluid model an equation describing small perturbations of cold plasmas is obtained. It is shown that perturbations with a finite longitudinal (along the magnetic field) wave numbers can be unstable if the profile of the angular velocity of ions rotation is inhomogeneous in radius. The mechanism of this instability is associated with the action of the Coriolis force on ions and is due to the finite inertial response of electrons along the magnetic field lines. The instability develops aperiodically: ω = iγ, Re (ω) = 0.

For the power-law profile of the rotation velocity and zero boundary conditions for the radial displacement of ions and electrons at the plasma-wall boundary, the eigen-frequencies of unstable modes are obtained and their spatial structure is calculated. The influence of the geometry (length and radius) of the plasma cylindrical region on the instability growth rate is studied. It is shown that the instability growth rate is in the range $ω\_{Bi}<γ<ω\_{lh}$, where $ω\_{LH}=\sqrt{ω\_{Bi}ω\_{Be}}$ is the lower hybrid frequency and $ω\_{Be}$ is the electron cyclotron frequency.

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References

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1. \*) [abstracts of this report in Russian](http://www.fpl.gpi.ru/Zvenigorod/XLVII/Lt/ru/FG-Marusov.docx) [↑](#footnote-ref-1)