Operation of a Bench Coaxial Gyromagnetic Line at Low Power for Compact Applications

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Gyromagnetic lines are nonlinear transmission lines of coaxial or rectangular shapes loaded with ferrite beads as magnetic medium, which is saturated by a bias axial field [1]. As a fast input pulse with rise time of less than 2-3 ns is injected into the line, the current pulse generated induces an azimuthal field that interacts with the axial field, allowing the line to operate in two regimes as pulse sharpeners or RF generators. If the azimuthal field is negligible compared to the axial field, only pulse sharpening occurs, but if both fields are of the same order the precession movement takes place with the displacement of the ferrite magnetic domains around the effective field formed.

Recently, the main interest has been focused on the latter in applications for RF generation in defense systems for counter-unmanned aircraft systems (CUAS) in battlefield [2] or in the transmitting systems of pulse UWB radars. Normally, the gyromagnetic lines found in the literature work with moderate power using voltage excitation between 5-30 kV, line length of the order of 50-100 cm and a solenoid responsible for producing the axial magnetic bias in the range of 13 -25 kA/m [3]. To obtain a compact system, the ongoing research [4, 5] has investigated three methods: a) replacing the solenoid by permanent magnets, b) using a line with a shorter length (20- 30 cm) and c) exciting the line with voltages below 5 kV. As the solenoid replacement implies in the lack of frequency tunability, the objective of this work is to study the operation of a gyromagnetic line in a regime of low voltage operation (< 5 kV), showing the performance of a conventional line length (60 cm) versus a shorter one (30 cm). We expect to present the results of the experimental characterization of both the lines on these specified conditions at the time of the conference.

Work supported by agencies AFOSR (contract FA8655-25-1-8007), CNPq (grant 304465/2022-4) and AEB.

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2026 IEEE International Conference on Plasma Science (ICOPS) | 979-8-3315-8136-7/26/$31.00 ©2026 IEEE | DOI: 10.1109/ICOPS53334.2026.11660202

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