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5P42 - The Development of Capacitive Nonlinear Transmission Lines and Their Performance Limits

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The generation of radiofrequency through Nonlinear Transmission Lines (NLTLs) have been investigated as an alternative way to build RF generators for application in telecommunication, medical and defensive electronic countermeasures systems. Two main configurations of NLTLs were reported in the literature: discrete lines that comprise a network of LC sections built with nonlinear components and the gyromagnetic line that consists of a coaxial transmission line loaded with ferrite-based magnetic cores. Gyromagnetic lines produce high voltage microwave oscillations with frequency ranging from few hundred of MHz up to less than 10 GHz requiring, however, an external magnetic polarization. On the other hand, discrete lines are suitable for RF generation in a lower frequency range from a few MHz to hundreds MHz, having a better prospect for use in compact systems. Capacitive NLTLs require the use of components that present voltage dependence behavior of the capacitance as ceramic capacitors or special diodes. While lines built with ceramics capacitors show a maximum operating frequency around tens of MHz requiring high input voltage, the use of silicon varactors diodes allows the construction of low voltage lines, nevertheless by using carbide silicon Schottky diodes the output of a capacitive NLTL can provide a few kV of oscillation peaks. This paper presents some experimental results that show the development of the capacitive NLTLs at the Plasma Laboratory (LABAP) of the National Institute for Space Research (INPE) in Brazil. The analysis of the experimental results points that performance limits of capacitive NLTLs are closely related to the characteristics of the nonlinear component used in their construction and leads to the conclusion that an improvement of their performance requires the development of new nonlinear components, which present simultaneously nonlinear capacitance to voltage behavior, low losses and thermal stability.
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