

### 具有高稳定性的超高增益回旋行波管放大器

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## An Ultra-high Gain Gyrotron Traveling-Wave Amplifier with High Stability

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摘要

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摘要 该文结合线性理论和自洽非线性理论对Ka波段TE<sub>11</sub>模超高增益回旋行波管放大器的稳定性进行了研究。研究揭示了回旋行波管中前向波绝对不稳定性和返向波振荡之间的区别,以及分布损耗技术对这两种自激振荡的抑制作用,并首次提出通过渐变磁场技术来提高系统的稳定性。基于该分析方法设计的Ka波段超高增益回旋行波管,采用电压100 kV,电流7 A,速度零散5%的电子注,获得了-1 dB的饱和功率带宽约5 GHz,最高增益约80 dB。

关键词: 回旋行波管 毫米波 稳定性

Abstract: The linear theory together with the self-consistent nonlinear theory are applied to systematically study the stability of a Ka-band TE<sub>11</sub> mode ultra-high gain gyrotron Traveling-Wave Amplifier (gyro-TWA). The analysis reveals the differences between the forward-wave absolute instability and the backward-wave oscillation, as well as the suppressing effect to these self-excited oscillations by using distributed loss technique. Using properly down-tapering the magnetic in the nonlinear stage to improve the stability of the system is proposed for the first time. Based on the analysis, a Ka-band TE<sub>11</sub> mode gyro-TWA with ultra-high gain ability is designed, which adopts an electron beam with voltage of 100 kV, current of 7 A, velocity spread of 5%, and is capable of obtaining the -1 dB saturated bandwidth about 5 GHz and the highest gain about 80dB.

Keywords: Gyro-TWT Millimeter wave Stability

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