

### 具有高稳定性的模式选择电路回旋行波管放大器

杜朝海<sup>①②</sup> 刘濮鲲<sup>①</sup> 薛谦忠<sup>①</sup> 张世昌<sup>①\*</sup>

<sup>①</sup>(中国科学院高功率微波源与技术重点实验室中国科学院电子学研究所 北京 100190)

<sup>②</sup>(中国科学院研究生院 北京 100039)

### A Mode-selective-circuit Gyrotron-traveling-wave Amplifier with High Stability

Du Chao-hai<sup>①②</sup> Liu Pu-kun<sup>①</sup> Xue Qian-zhong<sup>①</sup> Zhang Shi-chang<sup>①\*</sup>

<sup>①</sup>(Key Laboratory of High Power Microwave Sources and Technologies, Institute of Electronics, Chinese Academy of Sciences, Beijing 100190, China)

<sup>②</sup>(Graduate University of Chinese Academy of Sciences, Beijing 100039, China)

摘要

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**摘要** 该文基于线性理论和自洽非线性理论,对具有模式选择特性的损耗陶瓷和金属环交替加载的Ka波段TE01模回旋行波管放大器进行理论建模和稳定性分析。分析表明损耗陶瓷加载波导具有模式选择特性,其传输特性类似于光滑圆波导;稳定性分析揭示了相互作用系统自激振荡的内反馈机制。将理论分析与美国海军实验室的实验工作进行了比较,证明了该文理论模型的可靠性。该文的理论模型对回旋行波管放大器的设计具有一定的指导意义。

**关键词:** 回旋行波管 损耗陶瓷 模式选择 稳定性

**Abstract:** This paper devotes to modeling and the stability study of a Ka-band TE01 mode gyrotron Traveling-Wave Tube (gyro-TWT) based on a modal selective circuit alternately loaded with lossy ceramic shells and metal rings. The linear theory and the self-consistent nonlinear theory are applied to analyze the stability of the equivalent interaction circuit. The study reveals that the lossy dielectric-loaded waveguide is with modal selective ability, and its propagation characteristics are similar to that of the circular empty waveguide. The internal feedback physics of the self-excited oscillations are revealed in the stability analysis. The consistency between the theoretical analysis and the experimental tests of American Naval Research Laboratory indicates the reliability of this study. The theoretical model in this paper brings guidance for future designing a gyro-TWT.

**Keywords:** Gyro-TWT Lossy ceramic Modal selective Stability

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通讯作者: 杜朝海 Email: duchaohai@gmail.com

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