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Reentrant double-staggered ladder coupled-cavity structure for X-band traveling-wave tube

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Author(s)

Lingna Yue ; Jianbin Huang ; Gangxiong Wu ; Yanyu Wei ; Wenxiang Wang ; Yubin Gong

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Abstract:

The paper describes the design of an X-band coupled-cavity traveling-wave tube (CC-TWT) based on the reentrant double-staggered ladder coupled-cavity slow wave structure (SWS) using High Frequency Structure Simulator (HFSS) and particle-in-cell (PIC) code in Computer Simulation Technology (CST) Particle Studio. When the cathode voltage and cathode current are 25.9 kV and 5 A, respectively, the PIC simulation results show that the corresponding saturated output power is over 20kW from 8.6 to 9.7 GHz, the maximum output power can reach 28.8 kW at 9.2 GHz, and the electronic efficiency and the gain can reach over 15.6% and 40 dB.

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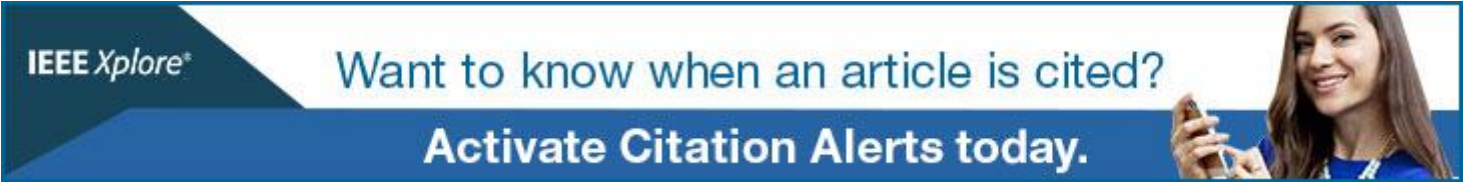
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I. Introduction

Traveling-wave tubes (TWTs) are important microwave amplifiers that are used immensely in satellite communications, military radar systems and electronic countermeasures [1]–[2]. The Helix TWT has wider bandwidth than the coupled-cavity TWT, however, the coupled-cavity TWT has excellent performance in power capacity compared with the helix TWT [3]–[5]. Then, there is still great interest in the study and development of high-power coupled-cavity traveling-wave tube. As one of coupled cavities, the re-entrant double-staggered ladder-coupled cavity has advantages of relatively wide frequency bandwidth, moderate interaction impedance and easy fabrication compared with other ladder coupled cavities in millimeter-wave range.

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