

考虑空间电荷效应时速调管射频间隙耦合系数的理论与模拟

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The Theory and Simulation of the Klystron RF Coupling Coefficient with the AC Space Charge Effects

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摘要

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摘要 在大功率速调管中, 由于电子注电流较大, 间隙距离较长, 在间隙中由电子群聚产生的交流空间电荷效应不可忽略。根据传统的运动学理论来计算速调管间隙耦合系数, 并没有考虑这个效应, 计算的结果高于实际值。该文利用Webster去聚理论, 建立了在任意间隙场分布情况下, 考虑空间电荷效应的间隙耦合系数计算模型。利用粒子模拟工具, 进行了仿真模拟, 理论计算与仿真结果一致。

关键词: 速调管 间隙耦合系数 交流空间电荷效应 粒子模拟

Abstract: In the high power klystrons, the AC space-charge effects from the bunching of electrons in gap can not be ignored due to the higher beam current and longer gap distance. The traditional coupling coefficient calculation model according to the simplified kinematic theory does not take the effects in account, so its result is higher than the actual value. This paper develops a new coupling coefficient model based on the Webster debunching theory considering the AC space-charge effects with arbitrary gap field distributing. In addition, a simulation study of the coupling coefficient is given using the particle-in-cell code. The simulation results show agreement well with the calculating results.

Keywords: Klystron Gap coupling coefficient AC space charge effects Particle-in-cell simulation

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