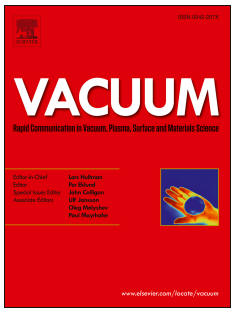

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The Study of a Coaxial Gyrotron with Misaligned Inner Rod

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The effects of a tiny misalignment of the inner rod in a coaxial-gyrotron on the eigenvalue, quality factor *Q*, resonant frequency, and electronic efficiency are investigated. As a practical application, with the electronic velocity spread and cavity wall resistivity being taken into account, the beam-wave interaction of a 170 GHz megawatt coaxial-gyrotron operating with $TE_{31,12}$ mode has been studied. The results show that the eigenvalue of the operating mode decreases slightly when the ratio of misalignment to outer radius *D*/*R* increases for the case of smaller values of the ratio of outer to inner radius $C=R/R_{in}$, but is unchanged with the increasing value of *D*/*R* for the case of large ratio of *C*. The electronic efficiency decrease slightly when *D*/*R* increases within the range of 0-0.015. However it decreases at a faster rate when *D*/*R* is larger than 0.015. If *D*/*R* increases to 0.024, the efficiency decreases sharply to only about 2.2%. For both cold and hot cavity, the resonant frequency decreases slightly with *D*/*R* increasing.

Keywords:
Coaxial-gyrotron
Eigenvalue
Efficiency
Interaction
Misalignment

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1. Introduction

As the devices of efficient and stable high-frequency and high-power microwave sources, coaxial-gyrotrons have the advantages of reduced mode competition, larger power capability, and fewer mitigated restrictions of voltage depression and limiting current [1-3]. So the study of coaxial-gyrations is receiving increasing attention. Karlsruhe Institute of Technology (KIT) (former FZK) in German tested a corrugated coaxial-gyrotron in the designed $TE_{31,17}$ mode with 1.5 MW output power at 165 GHz at first. On the basis of these, KIT have successfully developed a corrugated coaxial-gyrotron in the designed $TE_{34,19}$ mode with 2 MW output power at 170 GHz [4-7]. In engineering applications, due to the limitation of precision that the processing equipment can achieve, the misalignment or tilt of the inner rod unavoidably occurs. The misalignment or tilt of the inner rod changes the eigenvalue of coaxial waveguide and boundary conditions of electromagnetic field. Thus the whole characteristics of coaxial tube are affected. The effects of misalignment of the inner rod on the eigenvalue, resonant frequency, distribution of Ohmic loss, and characteristics have been studied in references [8-11].