Analysis of a Corrugated Coaxial Waveguide Resonator for Mode Rarefaction in a Gyrotron

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—Canceled Talk—
In the development of high-power, high-frequency gyrotrons,
two major constraints are the thermal loading of the
wall of the waveguide resonator and the potential depression
inhibiting the transport of large electron beam currents. The introduction of a coaxial metal insert in a circular waveguide
resonator reduces the potential depression caused by the
presence of the electron beam, and thus a coaxial waveguide
transports a higher vacuum limiting current than a circular
waveguide (without such a coaxial insert). The enhanced current
transport capability of a gyrotron using a coaxial waveguide
increases the electron beam power available in the device for
conversion to microwaves. An unfolding method of selecting the desired mode amongst the competing nearby
modes in a coaxial cavity interaction structure by tapering the structure cross section will be presented.

Summary

The analysis of a coaxial waveguide resonator with
its central conductor corrugated with wedge-shaped slots, considering
space harmonic effects due to slot periodicity can be used to
study the problem of mode competition in a gyrotron. A more positive
slope of the plot of the eigenvalue versus the ratio of the waveguide
wall to outer slot radii (coaxial parameter) for the desired
mode, typically, TE8,4 as compared to the corresponding slopes
for the competing modes formed a basis for the study of mode separation.
Considering the aspect of mode separation on the basis
of the relative slopes of the eigenvalue plot and that of mode degeneracy, a tradeoff was made to select the slot depth at a value
intermediate between the values corresponding to the narrow and
deeper slots. For the slot depth parameter selected, one may find
the coaxial parameter, around which to taper the structure cross
section, for mode separation on the basis of relative slopes of the
eigenvalue plot, avoiding, at the same time, the region of the mode
degeneracy. The analysis and interpretation of results for mode
separation with reference to the typical mode TE8,4 chosen is extendible
to higher modes as well.

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