Abstracts

Multimode Oscillation and Mode Competition in High-Frequency Gyrotrons

K.E. Kreischer, R.J. Temkin, H.R. Fetterman and W.J. Mulligan. "Multimode Oscillation and Mode Competition in High-Frequency Gyrotrons." 1984 Transactions on Microwave Theory and Techniques 32.5 (May 1984 [T-MTT]): 481-490.

Stable operation in a single mode is an important goal of high-power gyrotrons. Both multimoding and switching into unwanted modes can lead to lower efficiency and undesirable heating of components not designed to accommodate parasitic modes. We have extensively studied mode behavior in a pulsed 100-kW, 140-GHz gyrotron using a variety of mixing techniques. As a result, a number of multimoding regions have been identified. Two possible explanations are presented. If the ratio of beam thickness to cavity radius is relatively large, different parts of the beam can excite different modes. Secondly, it can be shown theoretically that, under certain conditions, the presence of one mode can enlarge the excitation region of a neighboring, parasitic mode by favorably prebunching the beam. Experimental evidence strongly supports this latter interpretation. To our knowledge, this is the first use of mixing techniques in conjunction with the study of gyrotron operation. These diagnostic methods are important becanse they can conclusively identify the presence of parasitic modes, even when these modes are weakly excited.

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