Abstracts

Theory and Numerical Modeling of a Compact Low-Field High-Frequency Gyrotron

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The electron-cyclotron maser interaction provides an extremely efficient means of generating high-power radiation in the millimeter and submillimeter regimes. For devices where both high frequencies and low magnetic fields are required, high cyclotron-harmonic interactions must be considered. We present here a linear and nonlinear analysis of a TE/sub m11/ whispering-gallery-mode gyrotron. Resonances at the mth and (m ± 1)th cyclotron harmonic are found. The start oscillation condition is calculated from linear theory for a wide range of parameters. Maximum efficiency for different beam and cavity conditions is calculated with a fully relativistic numerical simulation code. High efficiencies, > 35 percent, have been found at the mth cyclotron harmonic. The effect on the efficiency of an initial velocity spread in the electron beam has also been considered.

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