Abstracts

Characteristics and Optimum Operating Parameters of a Gyrotron Traveling Wave Amplifier

Characteristics and optimum operating parameters are determined for a new type of high-power high-efficiency generator of millimeter waves known as a gyrotron traveling wave amplifier. In the example consided, wave amplification results from the interaction of a TE/sub 01/ waveguide mode with the fundamental cyclotron harmonic of an electron beam. The parameter optimization involves the determination of the point of maximum device efficiency as a function of beam density, beam energy, beam positioning, and external magnetic field for the output power required. An analytical linear theory and a numerical simulation code form the basis of theoretical calculations. As a result of the extensive survey in parameter space, the peak efficiency in the beam frame has been found to exceed 70 percent. This result has been applied to the specific design of a 35-GHz amplifier with output power ~340 kW, a power gain of 2 dB/cm, and a laboratory frame efficiency of 51 percent.