Abstracts

Theoretical Investigation of a Free-Electron Maser Operating with a TEM Transmission Line

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The possibility of using the transverse electric magnetic (TEM) transmission line in free-electron masers (FEM) is discussed. It is shown that at the centimeter and long-millimeter wavelengths such transmission lines allow one to combine the advantages of an open cavity and a waveguide-based resonator. A particular case of an FEM-based on the use of a shielded two-wire transmission line is investigated theoretically. A mathematical approach that allows one to calculate transmission-line parameters important to the FEM application is developed. It is based on the use of the integral equation technique and on a new representation of the Green function of the internal region of a circle, which was obtained in this paper. Numerical analysis of effective mode area, wave impedance, and attenuation constant was made for the odd TEM mode, which is excited in FEM operation. The FEM under research at Tel Aviv University was considered as an example. The frequency dependence of gain for an FEM operating in the linear regime was calculated. That the obtained gain value is much higher than the ohmic losses in the transmission line shows the possibility of using the TEM transmission line in this FEM.

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