The analytical design of a folded waveguide traveling wave tube and small signal gain analysis using madey's theorem

Abstract

We are developing an analytical model for the design of the folded waveguide traveling wave tube (FWTWT). This analytical model provides the physical view for rapid design optimization of the FWTWT. The design and analysis of the FWTWT using the spatial harmonics method of the TE_{10} mode of the EM wave are presented. An X-band FWTWT is used to verify this method. The normalized dispersion and beam line equations are used to simplify the design process so that the FWTWT can be designed to operate at any desired frequency. The small signal gain of an FWTWT is calculated by using Madey's theorem. The results of this analysis are compared with the numerical single particle simulation carried out using MATLAB. The results are in excellent agreement. The Madey's theorem can be used to provide a potential indication of the gain magnitude of the FWTWT.

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