Abstracts

Transmission-Type Esaki-Diode Amplifier Using Dielectric Loaded Rectangular Waveguide (Correspondence)

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Esaki diodes (tunnel diodes) have been widely used in microwave amplifiers. A number of papers have been published on Esaki-diode amplifiers constructed in stripline or coaxial line, In 1961, Pedinoff reported a transmission-type Esaki-diode amplifier using rectangular waveguide. For the antenna receiving application, the reflected power from the transmission-type Esaki-diode amplifier is radiated into space, and therefore it is used as a preamplifier of a receiver without connecting a circulator. In 1966, Yamashita et al. derived the equivalent circuit of the oscillator constructed with waveguide from the view point of Green's function, and Getsinger calculated the equivalent circuit from that given by Marcuvitz for the waveguide loaded with dielectric post. This correspondence proposes a new type of transmission-type Esaki-diode amplifier using rectangular waveguide and presents the results of the analysis and experiments on the laboratory amplifier. The conventional uniform waveguide mounted with an Esaki diode tends to be unstable and thus cannot be used as an amplifier. In order to prevent oscillation, the authors have proposed the utilization of cutoff waveguide connected at both sides with dielectric loaded waveguides. The equivalent circuit of the amplifier given by Getsinger is not applicable for our amplifier, because it has been obtained for the case of the uniform waveguide propagating TE/sub 10/ mode, in which an Esaki diode is mounted. In the derivation of the equivalent circuit described in this paper, the Esaki diode is regarded as a very thin dielectric post with negative conductance through which a filamentary current flows. The effect of the reflection of higher modes from the discontinuous surfaces (the interfaces between the cut-off waveguide and the dielectric loaded waveguides) near the post has been taken into account. The experimental results have been in fair agreement with the theory using this equivalent circuit.

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