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Analytical Terahertz Characterization of In0.53Ga0.47As Transistors and Homogenous Diodes

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Abstract : We propose an analytical model for the admittance and the noise calculations of the InGaAs transistor and diode. The development of the small-signal admittance takes into account the longitudinal and transverse electric fields through a pseudo two-dimensional approximation of the Poisson equation. The frequency-dependent of the small-signal admittance response is determined by the total currents and the potentials matrix relation between the gate and the drain terminals. The noise is evaluated by using the real part of the transistor/diode admittance under a small-signal perturbation. The analytical results show that the admittance spectrum exhibits a series of resonant peaks corresponding to the excitation of plasma waves. The appearance of the resonance is discussed and analyzed as functions of the channel length and the temperature. The model can be used, on one hand; to control the appearance of the plasma resonances, and on other hand; can give significant information about the noise frequency dependence in the InGaAs transistor and diode.

Keywords : InGaAs transistors, InGaAs diode, admittance, resonant peaks, plasma waves, analytical model
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