Abstracts

State-Space Analysis of the Quantum-Well Injection Transit Time Diode

D.R. Conn and P.D. Bauman. "State-Space Analysis of the Quantum-Well Injection Transit Time Diode." 1991 Transactions on Microwave Theory and Techniques 39.8 (Aug. 1991 [T-MTT]): 1403-1412.

A state-space linear model of the quantum-well injection transit time (QWITT) diode is developed in this paper. The resulting system of equations are suitable for time- and frequency-domain analysis of the QWITT diode with its external circuit, and since the eigenvalues (complex resonant frequencies) are an integral part of the formulation, the method is extremely useful for the design of oscillator circuits and for the study of stability problems that are associated with supplying bias to the diode. The model includes the effects of velocity overshoot and carrier diffusivity, as well as the physical geometry of the devices being studied. It is tested by comparing the predicted small-signal impedance with other well-known models for similar devices. Using state-space analysis, it is predicted that long diodes with a positive injection conductance will not have an input impedance with a negative real part at any frequency.

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