Abstracts

Tunnel diode nonlinear model for microwave circuits and active antennas

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Tunnel diodes have a unique property: negative differential resistance (NDR). The integration of tunnel diodes with other electronic devices creates novel, quantum functional devices and circuits. The enhanced functionality of these devices enables design of both digital and analog circuits with reduced complexity, size and better performance. In this paper we investigate the applications of a nonlinear, large signal model of the tunnel diode. This model is used to analyze tunnel diode characteristics under external conditions such as input RF signal and termination resistance. We also discuss the application of the model to simulate quantum-MMIC circuits. VCOs, and active antennas designed using tunnel diodes show power outputs in the range of -4 to -10 dBm in the 1-2 GHz band. The DC to RF conversion efficiency is about 8% in VCOs and 16% in the antennas.

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