Abstracts

State-Space Analysis of General IMPATT Diode Small-Signal Lumped Models

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The development of a lumped model for small-signal carrier-field interactions in an IMPATT diode results in a set of state equations. Using state-space analysis techniques, the equations are solved for the small-signal impedance of a general IMPATT diode as a function of dc bias current and frequency. Read, p-n, and p-i-n diodes are studied using realistic values for saturation carrier velocities and carrier-ionization rates. Curves indicating the influence of diode physical properties on the small-signal impedance are presented. By combining state equations describing the behavior of the external microwave circuit with the diode state equations, the small-signal oscillation frequency and threshold dc bias current of a coaxial IMPATT oscillator are determined.

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