Abstracts

Analysis of nonlinear behavior of power HBTs

Woonyun Kim, Sanghoon Kang, Kyungho Lee, Minchul Chung, Jongchan Kang and Bumman Kim. "Analysis of nonlinear behavior of power HBTs." 2002 Transactions on Microwave Theory and Techniques 50.7 (Jul. 2002 [T-MTT]): 1714-1722.

To accurately understand the linear characteristics of a heterojunction bipolar transistor (HBT), we developed an analytical nonlinear HBT model using Volterra-series analysis. The model considers four nonlinear components: r/sub /spl pi//, C/sub diff/, C/sub depl/, and g/sub m/. It shows that nonlinearities of r/sub /spl pi// and C/sub diff/ are almost completely canceled by g/sub m/ nonlinearity at all frequencies. The residual g/sub m/ nonlinearity is highly degenerated by input circuit impedances. Therefore, r/sub /spl pi//, C/sub diff/, C/sub depl/, and g/sub m/ nonlinearities generate less harmonics than C/sub bc/ nonlinearity. If C/sub bc/ is linearized, g/sub m/ is the main nonlinear source of HBT, and C/sub depl/ becomes very important at a high frequency. The degeneration resistor R/sub E/ is more effective than R/sub B/ for reducing g/sub m/ nonlinearity. This analysis also shows the dependency of the third-order intermodulation (IM3) on the terminations of the source second harmonic impedances. The IM3 of HBT is significantly reduced by setting the second harmonic impedances of Z/sub S/,/sub 2/spl omega/2/ = 0 and Z/sub S/,/sub /spl omega/2-/spl omega/1/ = 0.

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