Abstracts

RF linearity characteristics of SiGe HBTs

Guofu Niu, Qingqing Liang, J.D. Cressler, C.S. Webster and D.L. Harame. "RF linearity characteristics of SiGe HBTs." 2001 Transactions on Microwave Theory and Techniques 49.9 (Sep. 2001 [T-MTT] (Mini-Special Issue on the 2001 IEEE Radio Frequency Integrated Circuit (RFIC) Symposium)): 1558-1565.

Two-tone intermodulation in ultrahigh vacuum/chemical vapor deposition SiGe heterojunction bipolar transistors (HBTs) were analyzed using a Volterra-series-based approach that completely distinguishes individual nonlinearities. Avalanche multiplication and collector-base (CB) capacitance were shown to be the dominant nonlinearities in a single-stage common emitter amplifier. At a given I/sub c/ an optimum V/sub ce/ exists for a maximum third-order intercept point (IIP3). The IIP3 is limited by the avalanche multiplication nonlinearity at low I/sub c/, and limited by the C/sub CB/ nonlinearity at high I/sub c/. The decrease of the avalanche multiplication rate at high I/sub c/ is beneficial to linearity in SiGe HBTs. The IIP3 is sensitive to the biasing condition because of strong dependence of the avalanche multiplication current and CB capacitance on I/sub c/ and V/sub ce/. The load dependence of linearity was attributed to the feedback through the CB capacitance and the avalanche multiplication in the CB junction. Implications on the optimization of the transistor biasing condition and transistor structure for improved linearity are also discussed.

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