Injection schemes for TWT linearization

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Traveling Wave Tubes (TWTs), widely used as microwave amplifiers for communication applications due to their high power outputs, are desired to have high linearity and efficiency. The nonlinear behavior of these tubes leads to significant intermodulation and harmonic distortion in the output spectrum. A scheme based on amplitude and phase optimized second-harmonic injection to suppress nonlinear products in a TWT, has been proposed and studied both experimentally [1]; [2] and analytically [3]. Equalizers that effectively employ IM3 (third-order intermod) injection have been used to balance the nonlinear AM/AM (amplitude distortion) and AM/PM (phase distortion) effects. We are performing a detailed investigation of the harmonic and IM3 injection schemes, both experimentally and by simulations. Experimental studies have shown comparable IM3 suppression of $-30$dB for both schemes; at the same time providing some insights into why harmonic injection might be preferable. Another scheme utilizing simultaneous harmonic and IM3 injection has been conceptually demonstrated, that has the prospect of eliminating the phase sensitivity of the two latter schemes. Simulations using the frequency domain, large-signal TWT code, LATTE [4] are being carried out to interpret the experimental observations and device physics.

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