RF PA Linearization: Open-loop Digital Predistortion Using Cartesian Feedback for Adaptive PA Characterization

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This work combines the advantages of two different RF power amplifier (PA) linearization techniques: digital predistortion (DPD) and Cartesian feedback (CFB). Cartesian feedback, an extension of classical continuous-time feedback, is limited by the bandwidth of its loop transfer function; this bandwidth, in turn, puts an upper limit on the bandwidth of the data input. However, this limitation gives one the ability to continuously linearize the PA without extensive knowledge of the PA characteristics [1].

Digital predistortion is an inherently open-loop technique and thus does not suffer from bandwidth limitations. This technique requires detailed modeling or characterization of the PA to produce the new, distorted baseband symbols [2]. One can use CFB to characterize the PA over the input symbol constellation, creating a digital lookup table (Figure 1) to be used for open-loop DPD [3]. Behavioral simulations have shown substantial improvement in PA output spectrum (Figure 2) and ACPR. These advantages can be had for little increase in power or die area. In addition, techniques to speed training time are being investigated (i.e., describing the tradeoff between accuracy in the lookup table and the speed at which the table is produced). Moreover, the DPD scheme used is much less computationally intensive than most adaptive digital predistortion schemes in the literature [2].

Figure 1: A schematic representation of the CFB-created lookup table, showing a simple IQ constellation distortion due to a nonlinear PA.

Figure 2: Results from a behavioral simulation of the CFB-trained DPD system showing improved linearity.

REFERENCES