Fig. 2. 2x2 MIMO transceiver front-end baseband equivalent model

1), \cdots, c_{m\ell}(n - L_{cm} + 1)^T} \text{ and modeling the coupling between path } m \text{ to path } \ell. \text{ The measurement noise at the output of each PA is denoted by } v_\ell(n). \text{ Equation (5) allows to infer that to obtain a distortion-free signal } x_\ell(n), \text{ the PD should be able to invert the PA response } p_\ell[], \text{ remove the undesired coupled signal, and mitigate the effects of the IQ imbalance.}

III. MIMO PREDISTORTER

Due to the effects of crosstalk and IQ imbalance, the MIMO transmitter to be linearized follows a characteristic that can be described by a parallel nonlinear model. We consider for the derivation the linearization of one MIMO path. The PD coefficients are estimated using an indirect learning structure [1]. In that methodology the MIMO-PD parameters are estimated and copied to the predistorter avoiding the inverse model estimation required by direct learning techniques. However, upon several advantages, the indirect learning structure is affected by measurement noise at the PA output [9], [15]. Measurement noise creates a bias in the estimated model that increases with the model order. The effects of the measurement noise on the proposed technique are discussed and evaluated following a specific application in Section IV.

The proposed identification structure requires a feedback path where the RF signal at the output of the PA is down-converted and translated to baseband. The components of the down-converter, filters, DAC and mixer, need to be carefully designed in order to minimize its harmful effects over the performance of the identification technique. In our approach an ideal feedback path is considered. It is assumed that the demodulation is implemented digitally minimizing the demodulation errors. A feedback path without IQ demodulator imbalance and nonlinear effects was also considered in previous publications as [8]–[10]. In [5], [11] errors in the feedback loop and techniques to