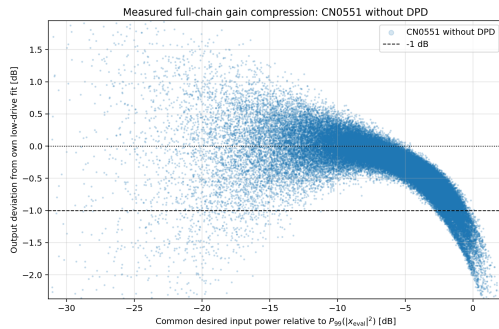
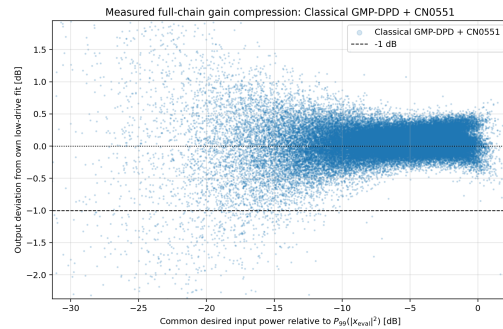


GMP- & TDCNN-Based DPDs

This project compares generalized memory polynomial- and time-delayed convolutional neural network-based digital predistortion for power-amplifier linearization, evaluating their accuracy and complexity. Both approaches reduce nonlinear distortion, with stronger comparative improvement depending on their selected limitations.



Gain Compression without DPD
(Source: Matteo Gambino)



Gain Compression with GMP-based DPD
(Source: Matteo Gambino)

Motivation

Power amplifiers (PAs) are ideally operated near saturation to improve efficiency, which introduces nonlinear distortion and spectral regrowth. Digital predistortion compensates for these effects by applying the inverse characteristic of the amplifier's nonlinearity, learned and approximated through training. This project investigates whether a neural-network-based predistorter can achieve equivalent results to those of an established generalized memory polynomial approach.

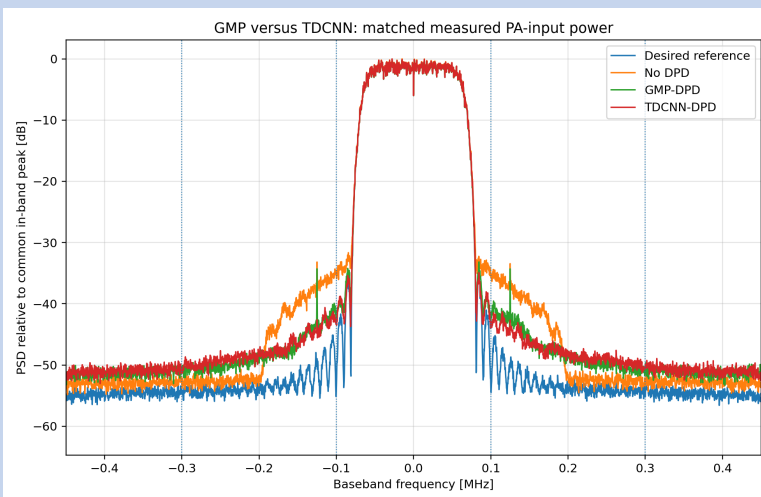
Approach

The two compared digital predistorters (DPD) were a generalized memory polynomial (GMP) and a time-delayed convolutional neural network (TDCNN). Both models were evaluated in three evaluation stages: an input-output sample-fitting comparison, a simulation of a full DPD and power amplifier cascade, and a comparison of different model-parameters on with an ADALM-Pluto/ CN0551 power-amplifier setup.

Results

Both predistorters yielded measurable reductions in nonlinear distortion and adjacent-channel spectral regrowth in the physical setup. The TDCNN achieved better results for a storage-constrained comparison, while the GMP required less computation. Overall, neither method showed a clear advantage. Despite the fact that the TDCNN does seem to be a promising alternative, future research needs to be done for more conclusive evidence.

Infobox



Project Team:
Matteo Gambino

Client:
Kontron Transportation Schweiz AG

Coach:
Prof. Dr. Mathieu Coustans