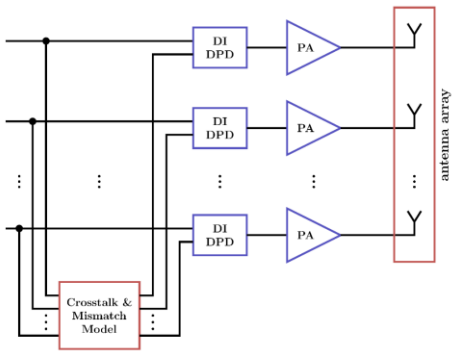
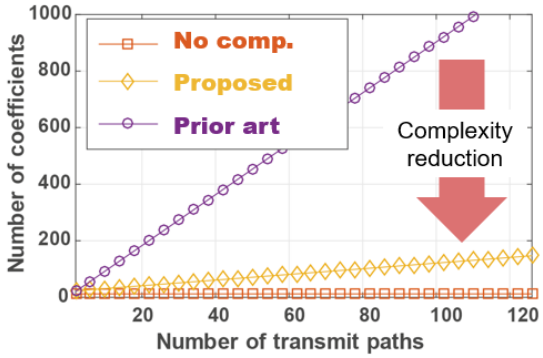
Low Complexity Linearization of 5G Transmitters

The Problem

Active antennas form the basis for improved efficiency and capacity in 5G and beyond 5G wireless communication systems. In practice, hardware impairments cause undesired behavior that must be compensated for – preferably with cost- and energy efficient digital signal processing techniques. One of the dominating impairments in such applications is the transmitter non-linear distortion caused by interactions between the various circuits through the antenna coupling. As the signal bandwidth and number of antennas increase – hundreds of individually driven elements are now being considered – the computational complexity of traditional techniques to solve this problem becomes unmanageable.

An Efficient Solution

Thanks to a thorough understanding of nonlinear distortion origins in active antenna transmitters, we were able to come up with a novel multi-antenna digital linearization technique. The method utilizes the knowledge that the nonlinear behavior of the active circuits can be decoupled from linear antenna effects. The result is a digital linearization technique for 5G and beyond transmitters with dramatically reduced complexity compared to previously existing techniques.

Proposed linearization scheme	Algorithm complexity
	

Impact

The proposed multi-antenna linearization technique was jointly developed by Chalmers and Ericsson employees, leading to Ericsson buying the invention and filing a patent [1]. The invention is now exploited as an important ingredient in Ericsson product development. The collaboration has resulted in a very well-cited scientific journal publication [2] and understanding which form the basis for ongoing research activities at Ericsson and Chalmers.

References

[1] K. Hausmair, T. Eriksson, C. Fager, U. Gustavsson, " Apparatus and method for identification and compensation of distortion in a multi-antenna system," US Patent 10,153,793, 2018

[2] K. Hausmair, P. N. Landin, U. Gustavsson, C. Fager, and T. Eriksson, "Digital Predistortion for Multi-Antenna Transmitters Affected by Antenna Crosstalk," *IEEE Trans. Microw. Theory Tech.*, pp. 1–12, 2017