

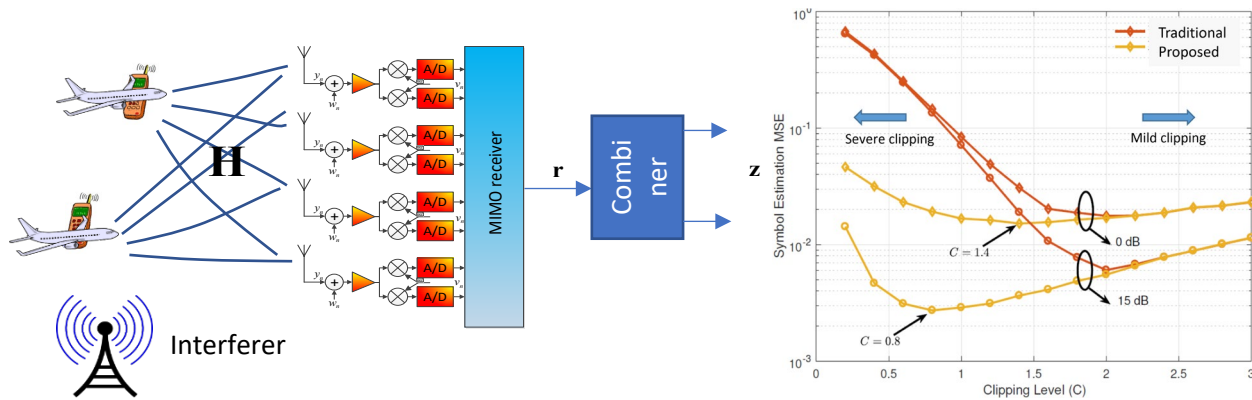
A receiver robust to clipping distortion

The Problem

The dynamic range of a receiver in a communication or radar system is of large concern. The system must consider the possibility that there may be a strong interferer close to the receiver, which can lead to that the desired signal is entirely drowned in a stronger undesired signal. In particular, the input signal to the analog-to-digital converters (ADCs) in the system must be attenuated to avoid clipping, i.e. signal amplitude limiting, which leads to poor signal-to-noise ratio (SNR) of the desired signal, and costly and power-hungry high-resolution ADCs.

The Solution

When analyzing the problem, it was understood that even with a strong interfering signal, the clipping did not appear for all receiver branches at all times. Since samples with clipping were easily detected, schemes that put more importance on unclipped samples was developed, through optimal mathematical and statistical analysis techniques. Although clipped samples carry less information than unclipped, they still contribute, and the end result is a multi-antenna receiver with a performance that is very robust towards clipping distortion.



Impact

Chalmers and Ericsson employees jointly worked on this problem and developed a clipping-optimal receiver with a significantly improved performance. Both Ericsson and SAAB found the research important, and it led to Ericsson buying the invention and filing a patent [1]. The collaboration has led to an increased understanding of the problem, and has also resulted in journal [2] and conference [3] publications.

References

- [1] N. Kolomvakis, T. Eriksson, M. Viberg, and M. Coldrey, **Clipping Restoration Receiver for Massive MIMO**, Ericsson ref P77445 WO1, PCT/EP2019/060364
- [2] N. Kolomvakis, T. Eriksson, M. Coldrey, M. Viberg, **Reconstruction of Clipped Signals in Quantized Uplink Massive MIMO Systems**, IEEE Trans. Communications vol. 68, no. 5, pp 2891-2905, 2020.
- [3] N. Kolomvakis, T. Eriksson, M. Coldrey, M. Viberg, **Quantized uplink massive MIMO systems with linear receivers**, IEEE Int. Conf. on Communications (ICC), 2020.