My name is François Rottenberg, I am an assistant professor at the Technological Campus Ghent of KU Leuven. My research interests are centered around signal processing for communications. In June 2022, I had the change to benefit from an INTERACT grant to perform a short term scientific mission (STSM) at the lab of Dr. Xavier Mestre at the Centre Tecnològic de Telecomunicacions de Catalunya (CTTC) in Casteldefells, Spain.

The main goal of the STSM was to design smart massive MIMO precoders that effectively minimize the consumed power of base stations, relying on realistic hardware models, nonlinear signal processing and machine learning. The overarching motivation of this project was the fact that energy consumption of mobile networks is growing at a fast pace and is becoming an increasingly important concern regarding climate objectives [1]. Most of the current massive MIMO precoder designs are obtained subject to a constraint on the transmit power [2]. However, the consumed power is not linearly proportional to the transmit power. For instance, the power amplifier (PA), one of the most consuming component of a base station, depends on its operation point with respect to its saturation region, implying a nonlinear dependence [3]. As a result, most commonly used precoders are not optimal in terms of energy consumption.
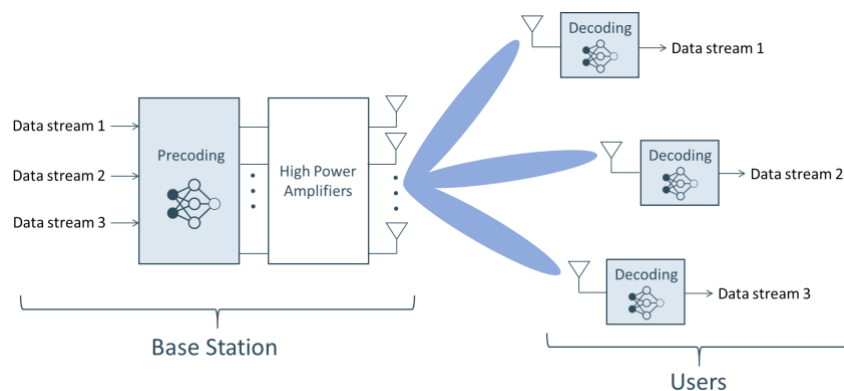
Great energy reduction gains can be achieved by considering instead both a realistic power consumption model and the nonlinear PA characteristic into the precoder design. This is what we investigated in this STSM with two different approaches. The first one is an analytical signal processing approach following the one I started in [4]. However, the problem is highly nonlinear and nonconvex, making it challenging to solve in complex scenarios, having for instance a large number of users. Therefore, we also considered a self-supervised learning approach, in collaboration with Thomas Feys, one of my PhD student at KU Leuven, who was also performing a research stay at CTTC. My research ideally came in the middle of his stay and allowed to perform a mid-term face-to-face meeting to evaluate progress and future directions. We already have promising pilot results and are looking forward to sharing them at a future INTERACT meeting. Stay tuned!

To finish, I would like to warmly thank Dr. Xavier Mestre for welcoming me at CTTC and the INTERACT COST action that supported my STSM. I strongly believe in international collaborations and face-to-face interactions. Even if the quality of online meetings has been recently greatly improved, nothing replaces for me sitting at the same table and doing a pen-and-paper brainstorming session. This was actually my fifth visit at CTTC since my PhD. I can only strongly recommend INTERACT researchers to apply to the available STSM grants of the action!

References

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