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Improper Signaling and its applications on interference management and physical layer secrecy mechanisms

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Statistically improper signals, in very general terms, are complex signals with I/Q imbalance and correlations between their real and imaginary parts. They hold fundamental applications in communications, including basic modulation schemes such as BPSK and QAM signals. Taking into consideration of the impropriety of complex signals in receiver design (also known as widely-linear receive filters) has shown to be beneficial in the GSM era and currently in voice applications of 3GPP. In contrast, we consider the optimizations of widely-linear transmit filters and relay processing. We will see in this presentation that widely-linear transmit strategies can be used for interference management and physical layer secrecy mechanisms. In a two-user interference channel, widely-linear transmit strategies are shown to improve the achievable rate regions; whereas in a relay-assisted interference channel, widely-linear transmit and relay strategies are shown to improve the secure degrees of freedom: the number of secure data streams supported by the system.