Parallel Data Transmission

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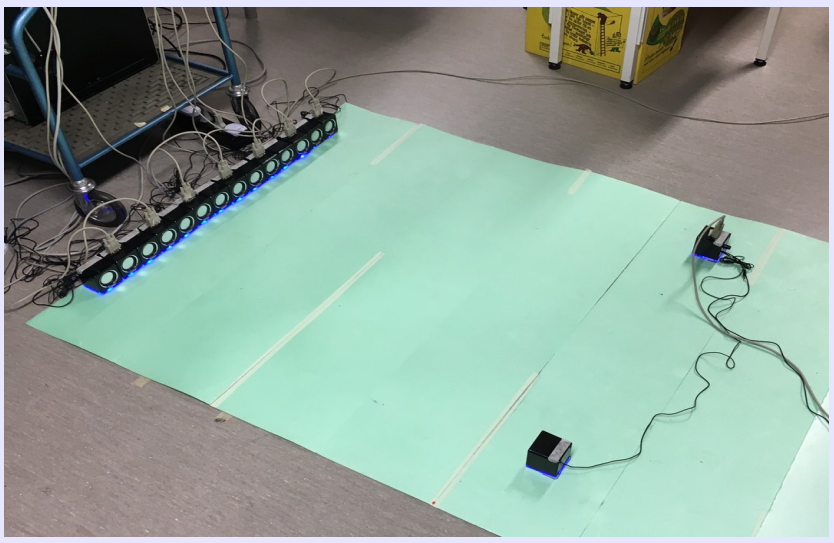
• *Introduction*

Massive Multiple-Input Multiple-Output (MIMO) is the very foundation of parallel data transmission. This is a theory of wireless communication where the base station is equipped with a large amount of antennas (thus massive MIMO) which allow the station to “beamform” signals. The purpose is to let the base station transmit data to several terminals in the same frequency band and time instance. This is done by focusing a given signal at the position of the terminal, by means of constructive interference. The signal can also be attenuated at the positions of the terminals sharing the same base station to prevent cross-talk.

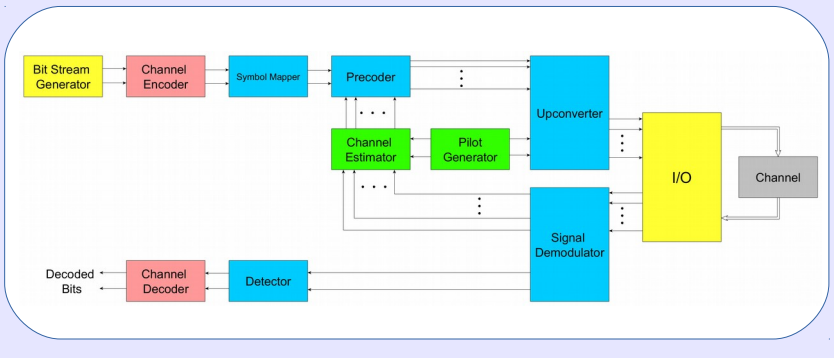
In a project conducted at the division of Communication Systems at Linköping University five student created a system to demonstrate the capabilities of massive MIMO. The project was carried out during the fall of 2015 as part of a CDIO course.

• *The System*

The system uses hardware built in a previous project. The hardware consists of 16 loudspeakers/microphones that can act as MIMO array elements or terminals, which is chosen by the user. The communication is therefore carried out by sound waves. The system is operated from a GUI. The GUI enables a large range of input and output parameters together with signal plots.

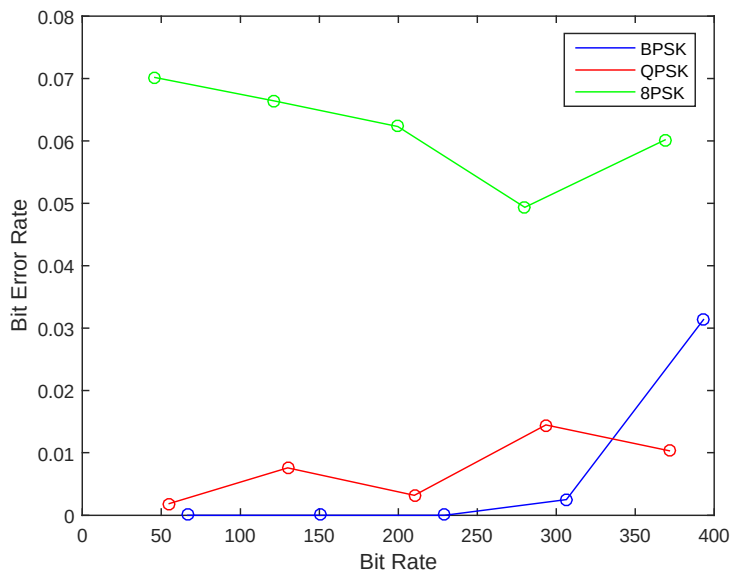


By letting the terminals initially send known orthogonal pilot sequences the base station can estimate the channel responses between each MIMO array element and terminal. The estimated channel responses are used to precode the modulated signals to enable a parallel data transmission. To minimize the bit error rate error correcting code was implemented in the system.

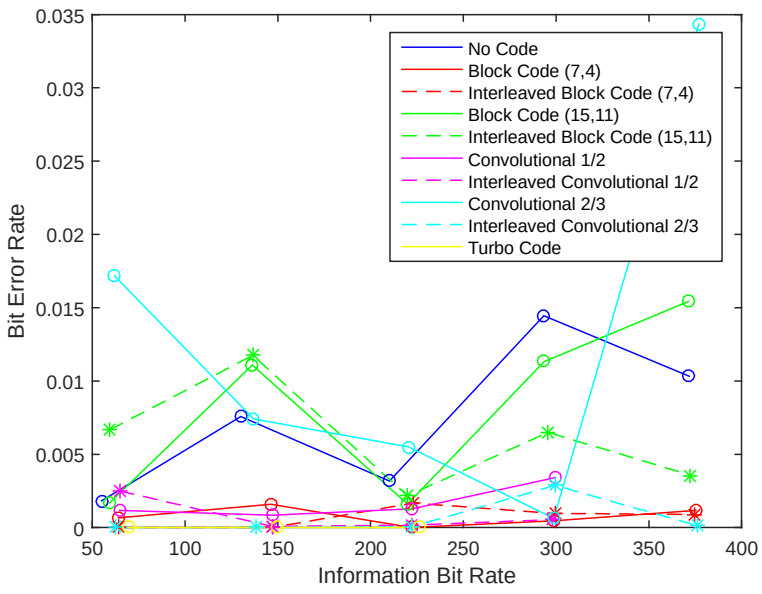


• *Results*

Testing has verified that the system is able to perform parallel transmission using 2, 3 and even 4 terminals. The test results of using 2 terminals and 14 MIMO array elements are displayed in the figures below.



Measured information bit rate and bit error rate of different modulation schemes.



Measured information bit rate and bit error rate of different channel coders combined with QPSK.

• *More Information*

More information about the project can be found on the project web page:

http://www.isy.liu.se/edu/projekt/tsks05/2015/pdt/