# SDR IMPLEMENTATION OF OFDM-BASED PHYSICAL LAYER NETWORK CODING

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*Course: QH-2010-I/CQ, Major: Electronics and Telecommunications Engineering*

**Abstract:**

Network coding is a novel paradigm for multicast relay network. It minimizes the number of transmissions required to communicate a given amount of information across the network by applying processing at relay nodes. Thus, network coding improves network throughput beyond existing standards based on routing. From first proposition of network coding in 2000 by Ahlswede *et al.*, a significant number of theoretical results, such as physical-layer network coding (PNC), have been developed but only limited results are available on implementation of network coding on real channel and real time hardware.

This thesis presents a software-defined radio implementation of two-way relay network, in which two end nodes exchange information with the help of a relay node. The implementation model is designed to apply network coding and reduce number of transmissions from four (in traditional routing scheme) to two (as in physical-layer network coding scheme). In the first transmission (uplink), FDMA is applied to avoid interference between signals sent out from end nodes; and relay node use a two-branch receiver to get both these signals and decode data separately, then performs a bitwise XOR on these data. Afterwards, in the second transmission (downlink), relay node transmits the XORed data to end nodes.

The designed model is verified using GNU Radio (open-source software) and three USRPs (hardware) in an indoor environment. Simulation and experiment result show that with short messages, this model can achieve about 85.2% throughput gain over traditional scheme, which agrees with PNC theoretical analysis.

***Keywords:*** Network Coding (NC), Software-Defined Radio (SDR), Orthogonal Frequency Division Multiplexing (OFDM).