A Survey of Receiver Designs for Cooperative Diversity In The Presence of Frequency Offset

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A Survey of Receiver Designs for Cooperative Diversity in the Presence of Frequency Offset

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***Abstract*—Cooperative diversity is becoming a potential solution for future wireless communication networks due to its capability to form virtual antenna arrays for each node (i.e. user). In cooperative networks, the nodes are able to relay the information between the source and the desired destination. However, the performance of the networks (for instance – mobile networks, ad-hoc networks and vehicular networks) is generally affected by the mobility of the nodes. As the nodes' mobility rapidly increases, the networks are subjected to frequency offset and unknown channel properties of the communication links which degrades the system's performance. In a practical scenario, it is a challenging task and impractical for the relay and destination to estimate the frequency offset and channel coefficient especially in time-varying environment. In this manuscript, a comprehensive survey of existing literature for receiver designs based on Double Differential (DD) transmission and Multiple Symbol Detection (MSD) approach is presented to eliminate the complex channel and frequency offset estimation.**

***Index Terms*—Cooperative Diversity, Double Differential, Frequency Offset, Multiple Symbol Differential Detection.**

I. INTRODUCTION

IN recent years, wireless cooperative diversity has gained significant attention because of its capability to achieve low Bit Error Rate (BER), high network throughput, high data transmission reliability as well as spectral efficiency to support the demand for the rapid growth in wireless communications. By exploiting the broadcast nature and diversity gain of the wireless communication, cooperation between users can be realized without the requirement of physical antenna arrays being installed at the transmitting and receiving nodes [1,2]. The idea behind this technique is to enable the source to broadcast signals following independent wireless path towards its destination with the help of other node(s) that act as relay(s) in the transmission schemes such as One-Way Relay Network (OWRN) or Two-Way Relay Network (TWRN) in [3] as depicted Fig. 1. For OWRN, the transmission phase is divided into the broadcast and relayed phase. In the broadcast phase, the source broadcasts its information via a relay and directly towards the destination. The source then remains idle during the second (i.e. relayed) phase. Simultaneously, the relay processes the received signals and relays the processed signals to its intended destination. In TWRN, when two nodes are communicating with each other through a relay, the relay processes the superimposed (summed) of the received signal from both nodes and broadcasts it back to its corresponding node [3,4].

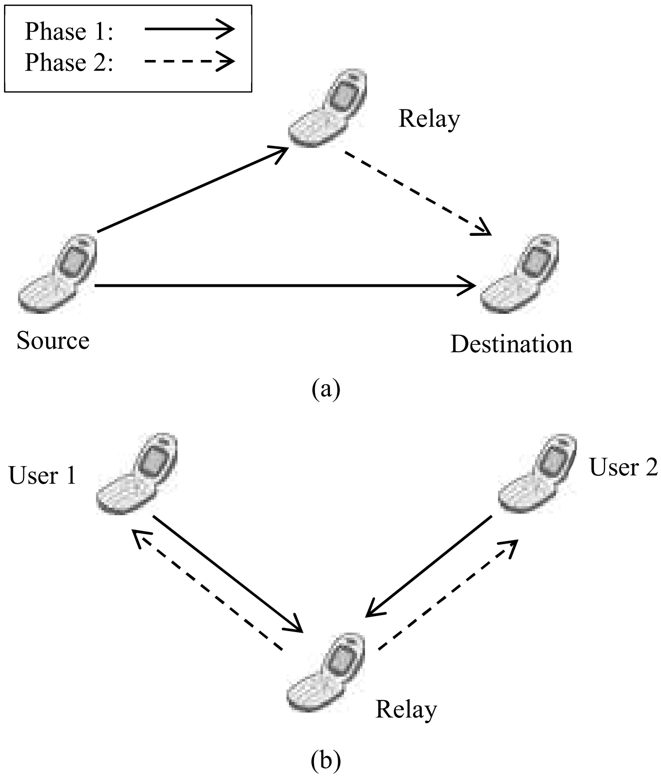

Figure 1: (a) One-Way Relay Network (OWRN) and (b) Two-Way Relay Network (TWRN) [3]

The received signal at the relay is processed based on several relaying protocols, such as Decode-and-Forward (DF) and Amplify-and-Forward (AF) [2,5]. For DF protocol, the relay decodes the source information and encodes the signals before retransmitting the information to the desired destination. However, the DF protocol may suffers from the error propagation problem constraint by the transmission of erroneous signal which deteriorates the whole system. On the contrary, in AF protocol, the relay receives the source information and simply amplifies the signals (both information and noise) with certain multiplication factors before retransmitting the scaled version of the signals towards the destination. The AF

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