

Cooperative-Diversity Selection in RF Energy Harvesting Networks



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Abstract

Reliable and affordable wireless communication is very essential for sustaining economic development. High demands for data services are throttling the existing wireless spectrum. This channel throttling can be tackled by spectrum diversity tendered by cooperative communications. Through cooperative diversity, relay channels provide independently fading links which are transmission links for data generated at the source to the destination. Unlike in multiple-input multiple-output (MIMO) techniques where transmission channels are created by multiple antennas at the source device, with cooperative techniques these channels are provided by other relaying devices. Equipping small user terminals with many antennas is not always practical because of their size. The main contribution of this dissertation is to take advantage of the relay selection diversity from cooperative communication protocols and radio frequency (RF) energy from energy harvesting techniques which are the baseline for cooperation at the physical layer level to improve performance of wireless communications in terms of outage probability and extended coverage. A robust relay selection procedure is proposed on conventional relays and buffer-aided relays where relays harvest RF energy and cooperate by exploiting the broadcast nature of wireless channels.

In wireless transmissions, the signal quality is randomly degradative in nature due to bad channel quality resulting from fading effects of multi-path propagation. Cooperative diversity networks become a useful solution to provide reliable data-rate coverage through high diversity gain and an improved spectral efficiency in bps/Hz through multiplexing gains. Cooperative communications technology also becomes a favourite because of its lower RF transmit power requirements. Energy Harvesting techniques which have proven to be very potential can be deployed to convert transmit RF power into useful energy which can be stored in accumulation to supply and sustain the very same cooperative network with energy. The performance analysis of this energy harvesting relay-aided cooperative network under Rayleigh fading will be modelled in terms of the outage behaviour. If the relaying nodes in

this cooperative network are equipped with buffers of finite size the performance is improved much further because of ease in the exploitation of best source-relay and relay-destination channel pairs for the relaying devices can decide when to receive and/or transmit. Conventional cooperative networks, reactive/partial opportunistic relay selection and in buffer-aided cooperative networks, Max-Max Relay Selection (MMRS) can be recognized as diversity-optimal strategies for relay selection and user scheduling in energy harvesting networks. This work aims at proving that with the same number of relays a balance can be attained between achieving a high diversity and improving cooperative network lifetime.