Energy Saving in Wireless Networks by Modified Physical Layer Algorithms

Abstract

In order to meet the ever growing demand for services that require larger data rates, like online video streaming, video calls, navigational systems etc, researches are focused to improve existing systems while bringing out new technologies. Communication at higher data rates needs more power if the channel is highly noisy and highly fading, and that is the situation in urban areas. Transmission at higher power drains the battery of the user faster. In addition to that, transmission beyond a power level is hazardous to health. But, then transmission of higher data rates at lower power has limitation with range of coverage. Also, from the service provider's point of view, they are tied up with limited resources like bandwidth. So, new mechanisms need to be devised and/or existing ones be improved so that users can transmit at lower power yet achieving higher data rates and QoS, while the service providers can support more number of high-bandwidth users with available resources. Diversity scheme that does not need extra transmission or antenna is of prime interest, and modulation diversity (MD) is one such scheme. For a conventional multidimensional signal constellation, the modulation diversity is achieved by phase rotating the symbols by using an appropriate rotation matrix. The rotation matrix that is selected based on the parameter minimum-product-distance, for a given diversity order, often produces symbol values with high precision. The effect of reducing the precision of the rotated symbols, considering constellation with modulation diversity of order two, is investigated. While concentrating on diversity, multiplexing gain should also be taken care of. As a scheme that provides multiplexing gain but suffers from a serious drawback like high peak-to-average-power ratio (PAPR), orthogonal frequency division multiplexing (OFDM) is researched for reducing PAPR. A modified version of interleaved OFDM named as IFDM-PAI has been introduced and the PAPR performance has been tested with correlated data. A considerable performance gain can be observed. The Performance of the system is expected to be improved further by introducing better random interleaving methods. Next, two adaptive algorithms are proposed to search optimal values of phase rotation weights which, in turn, reduce PAPR. We calculate and compare the computational complexities of our algorithm with conventional PTS, and PAPR performance is evaluated. The energy efficient transmission policy of "*transmitting more when the SNR is favourable, and holding off from transmission when channel is bad*", creates delay in the network which will affect the overall throughput. So, a trade-off between power budget and delay is another aspect to look into, and some relevant works have been done reported in the literature. Our work considers energy optimization over a specified duration for double queue architecture of transmitter. Transmitter scheduling and its power allocation are considered on the basis of SNR and queue backlog. Frame length is interpreted as the number of observation time-slots over which arrival-rate averaging is performed which, in turn, is used for setting the terms for the average power constraint. Communication utilizing cooperation among nodes provides diversity gain as well as multiplexing gain for certain under privileged users who seek assistance of relays. A major concern of why a user should cooperate is solved in active-user cooperation models. Here, an OFDM based three-active-user cooperative communication model for Base-station controlled system has been developed. Our scheme is providing diversity gain and multiplexing gain.