Novel Reduced-Feedback Wireless Communication Systems

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Modern communication systems apply channel-aware adaptive transmission techniques and dynamic resource allocation in order to exploit the peak conditions of the fading wireless links and to enable significant performance gains. However, conveying the channel state information among the users' mobile terminals into the access points of the network consumes a significant portion of the scarce air-link resources and depletes the battery resources of the mobile terminals rapidly. Despite its evident drawbacks, the channel information feedback cannot be eliminated in modern wireless networks because blind communication technologies cannot support the ever-increasing transmission rates and high quality of experience demands of current ubiquitous services.

Developing new transmission technologies with reduced-feedback requirements is sought. Network operators will benefit from releasing the bandwidth resources reserved for the feedback communications and the clients will enjoy the extended battery life of their mobile devices. The main technical challenge is to preserve the prospected transmission rates over the network despite decreasing the channel information feedback significantly. This is a noteworthy research theme especially that there is no mature theory for feedback communication in the existing literature despite the growing number of publications about the topic in the last few years. More research efforts are needed to characterize the trade-off between the achievable rate and the required channel information and to design new reduced-feedback schemes that can be flexibly controlled based on the operator preferences. Such schemes can be then introduced into the standardization bodies for consideration in next generation broadband systems.

We have recently contributed to this field and published several journal and conference papers. We are the pioneers to propose a novel reduced-feedback opportunistic scheduling scheme that combines many desired features including fairness in resources distribution across the active terminals and distributed processing at the MAC layer level. In addition our scheme operates close to the upper capacity limits of achievable transmission rates over wireless links. We have also proposed another hybrid scheme that enables adjusting the feedback load flexibly based on rates requirements. We are currently investigating other novel ideas to design reduced-feedback communication systems.