Int J Sens Netw Data Commun 2017, 6:1(Suppl)
DOI: 10.4172/2090-4886-C1-009

Differential modulation in cooperative communications

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Internet of things (IOT) is emerging as the next technology supporting communication among things like machines, animals and human beings. By connecting billions of objects, a communication infrastructure that has low power consumption and low hardware complexity is required. Wireless sensor network is a network consisting of large number of sensors that can sense the environment and control physical phenomena. By using WSN with simple, inexpensive and low powered sensors, the IOT can be brought to very small objects. Differential modulation is a simple scheme that eliminates the need of channel state information (CSI) between the connecting objects. The basic idea of differential modulation is based on decoding the information by comparing the phase of a symbol with that of the previous symbol. Due to the absence of channel estimation procedure, the hardware complexity of the receiver is reduced and consequently the power efficiency is increased. The simplicity and efficiency of differential modulation has made it an attractive practical solution, with many standard technologies having adopted it, e.g., IEEE 802.11 and Bluetooth. In this talk, we will review the differential modulation and its potential in various applications. Further we will discuss the recent investigations and analyses on the performance of differential modulation in different communication scenarios and especially in cooperative communication scenario. Also, the effect of different channel fading models and object mobility on differential modulation will be discussed.

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OULU 5G test network – rationale, structure and rollout

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The 5th generation (5G) mobile communication systems are expected to revolutionize everything seen so far in wireless systems. The requirements for 5G vary by application but will include data rates ranging from very low sensor data to very high video content delivery, stringent low latency requirements, low energy consumption and high reliability. All of these technological requirements are expected to be achieved while keeping the same or lower cost than today's technologies. The application scenarios range from usual broadband mobile to machine-to-machine communications, real-time control with low latency and low data rate sensor networks with large number of nodes, to mention a few. There is general consensus that these goals cannot be met with one single technological solution. The next generation standard will contain a wide range of technology components that can be leveraged depending on time, place and needs. It is also quite evident that the next generation standard must be open enough to allow drastically new technologies not even known during the development phase. Depending on the expected time-frame for 5G roll-out, there are very different views on the 5G system concept. The World Radio communication Conference (WRC'15) was quite important in setting the directions towards the next standard. At WRC'15 new agenda items were suggested to the following WRC'19 event where final decisions on frequency allocations for 5G mobile systems will be made, thus highlighting the timeliness of our research agenda.

The planned timeline for 5G system standardization (first standard ready around 2019) means that major innovations will be related to novel spectrum sharing schemes, network virtualization, densifications of cells and other new network architectures including M2M and moving networks. Thus, it is quite clear that air-interface will not play a major role in the first phase of 5G, but will become quite critical beyond 2020 once new spectrum allocations towards higher frequency bands have been made. Thus, the key driver in Oulu based 5G test network is to develop new small cell focused operator business models and innovations around the test network.

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