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(54) Title: FEEDBACK REDUCTION FOR CODEBOOK SUBSET RESTRICTION

(57) Abstract: Systems and methods according to these exemplary embodiments provide for methods and systems for reducing uplink overhead from a user equipment, UE, (14) when performing communications in a mobile network. Reductions in uplink overhead may be achieved by using different control channel structures depending upon, for example, a subset of permissible transmit parameters which are under consideration for a particular connection.

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Feedback Reduction for Codebook Subset Restriction

RELATED APPLICATION

[0001] This application is related to, and claims priority from, Swedish Patent Application Serial No. 0701915-1, filed on August 23, 2007, entitled "Method and Arrangement in a Telecommunication System" to Bo Göransson and George Jöngren, the entire disclosure of which is incorporated here by reference.

TECHNICAL FIELD

[0002] The present invention relates generally to telecommunications systems, and in particular to methods and systems for improving efficiency in radiocommunications systems.

BACKGROUND

[0003] Radiocommunication networks were originally developed primarily to provide voice services over circuit-switched networks. The introduction of packet-switched bearers in, for example, the so-called 2.5G and 3G networks enabled network operators to provide data services as well as voice services. Eventually, network architectures will likely evolve toward all Internet Protocol (IP) networks which provide both voice and data services. However, network operators have a substantial investment in existing infrastructures and would, therefore, typically prefer to migrate gradually to all IP network architectures in order to allow them to extract sufficient value from their investment in existing infrastructures. Also to provide the capabilities needed to support next generation radiocommunication applications, while at the same time using legacy infrastructure, network operators could deploy hybrid networks wherein a next generation radiocommunication system is overlaid

onto an existing circuit-switched or packet-switched network as a first step in the transition to an all IP-based network.

[0004] One example of such a hybrid network involves an existing second generation (2G) radiocommunication system, such as the Global System for Mobile communication (GSM), onto which a next generation "long term evolution" (LTE) system is overlaid. As will be appreciated by those skilled in the art, GSM systems have been modified and updated over time. For example, GSM release 1997 added packet data capabilities using General Packet Radio Service (GPRS) and GSM release 1999 introduced higher speed data transmissions through a system called Enhanced Data Rates for GSM Evolution (EDGE). Although not yet standardized, LTE systems will ultimately be designed in accordance with a new version of the UMTS standards, see, e.g., 3GPP TR 25.913 available online at www.3gpp.org. Target performance goals for LTE systems currently include, for example, support for 200 active calls per 5 MHz cell and sub 5 ms latency for small IP packets. Each new generation, or partial generation, of mobile communication systems add complexity and abilities to mobile communication systems and this can be expected to continue with either enhancements to proposed systems or completely new systems in the future.

[0005] As these mobile communication systems continue to evolve, more data at higher bandwidths is expected to be transferred over mobile communication networks. One method for boosting the capacity and coverage of a wireless communication system involves the use of multiple antennas at the transmitter and/or the receiver end. These Multiple-Input-Multiple-Output (MIMO) systems exploit the spatial dimension of a communication channel in order to improve performance by, for example, transmitting several parallel information carrying signals. By adapting the transmission to the current channel conditions, significant

additional gains can be achieved in a wireless system. One form of adaptation is to dynamically adjust, from one transmission time interval (TTI) to another TTI, the number of simultaneously transmitted information carrying signals to what the channel can support. This is commonly referred to as (transmission) rank adaptation. Another form of adaptation is precoding, wherein the phases and amplitudes of the signals are adjusted to better fit the current channel properties. The signals form a vector-valued signal and the adjustment can be described as multiplication by a precoder matrix. A common approach is to select the precoder matrix from a finite and countable set, e.g., as contained within a codebook. Such a codebook based precoding is likely to be an integral part of various mobile communication networks, e.g., LTE or MIMO for High Speed Downlink Packet Access (HSDPA) in Wideband Code Division Multiple Access (WDCMA) system.

[0006] Codebook based precoding is a form of channel quantization. A typical approach when using a system, such as, LTE or MIMO in WDCMA, is to let the receiver recommend a suitable precoder matrix to the transmitter by signaling the precoder index over a feedback link. The transmitter may choose to override the recommendation of the receiver so that it might be necessary to signal the precoder index that is actually used in the transmission to the receiver. In order to limit signaling overhead, it may be desirable to keep the codebook size as small as possible. This design desire, however, needs to be balanced against the performance impact, since a larger codebook allows a better match to the current channel conditions.

[0007] Accordingly, methods, devices, systems and software for communicating codebook-related information, or other transmission parameters, are desirable.

SUMMARY

[0008] According to one exemplary embodiment, a method for communicating in a mobile network includes the steps of: receiving a message at a user equipment, wherein the message identifies a permissible subset associated with a set of transmission parameters, selecting, by the user equipment, one of the transmission parameters from the permissible subset, and transmitting an indication of the selected one of the transmission parameters using one of a plurality of different uplink control channel structures, the one of the plurality of different uplink control channel structures being selected based on the permissible subset.

[0009] According to another exemplary embodiment a user terminal includes a transceiver for sending and receiving signals, including receiving a signal which identifies a permissible subset associated with a set of transmission parameters, a memory device for storing the set of transmission parameters, and a processor, connected to the transceiver and the memory device, and for selecting one of the transmission parameters from the permissible subset, wherein the transceiver transmits an indication of the selected one of the transmission parameters using one of a plurality of different uplink control channel structures, the one of the plurality of different uplink control channel structures being selected based on the permissible subset.

[0010] According to still another exemplary embodiment, a method for communicating in a mobile network includes the steps of transmitting a message, wherein the message identifies a permissible subset associated with a set of transmission parameters, and receiving an indication of one of the transmission parameters which has been selected from the permissible subset on one of a plurality of different uplink control channel structures, the

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