Multiple Transmission Techniques With Defective Cell And Other Cell CSI

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***Abstract*—CoMP transmission for LTE-Advanced systems promises improved throughput and coverage performance, especially for cell edge users. The concert of CoMP systems heavily depends on the feedback feature and channel imperfections. The collision of quantized and deferred channel state information (CSI) on the standard feasible rate of joint transmission (JT) and coordinated beam forming (CBF) systems. CSI originate closed-form terminology and precise approximations on the estimated sum rate of CoMP systems with deficient CSI assuming small-scale Rayleigh fading, path loss attenuation, and other-cell interference (OCI).Multiple users are additional sensitive to CSI imperfections than single-user JT and Coordinated multipoint or cooperative MIMO is one of the capable concepts to progress cell edge user data rate and spectral efficiency. Interference can be subjugated or mitigated by assistance between sectors or different sites. Multimode transmission system that switches among CoMP schemes to exploit the addition rate. Finally, Multimode transmission (MMT) policy, which enables us to identify which CoMP scheme provides the largest throughput in each system operating regime, depending on the normal SNR, feedback bits amount of the delay on CSI, as well for instance on the number of antennas and users served. This scheme adaptively switches among different CoMP transmission modes to maximize the sum rate. Since different path loss attenuation is considered for the users and OCI is included in the model, several performance metrics cannot be derived in closed form. Use a moment matching technique to approximate the interference distribution, which is given by the weighted sum of chi-squared random variables, by a Gamma distribution.**

***Keywords*—Coordinated beam forming (CBF), Joint transmission, Cooperative communication, (JT), Coordinated multi-point transmission (CoMP), restricted feedback, other-cell interference (OCI), defective channel state.**

I. INTRODUCTION

The development of escalating stipulate for elevated quality of overhaul at the customer mortal or customer equipment (UE), coupled through the deficiency of wireless spectrum, need additional sophisticated communication such as wireless techniques to diminish inter cell interference and increase the cell boundary throughput. Coordinated multipoint (CoMP) transmission and reception techniques exploit multiple transmit and obtain antennas from multiple antenna site locations, which may or may not be in the right place to the same physical cell, to enhance the acknowledged signal quality as well as decrease the acknowledged spatial interference. Prescribed, although the a range of table text styles are provided. In existing system Downlink CoMP systems with quantized channel direction and feedback delay. Specifically, examine the consequence of quantized and deferred CSI (QD-CSI) on the standard sum rate concert of articulate and non- coherent JT, as well as of CBF systems, taking into description the consequence of distant-dependent pathway defeat reduction and OCI. First, we afford a common framework, which allows us to obtain closed-form terminology and precise approximations for the standard realizable rates of CoMP systems with QD-CSI We primarily inspect the presentation of CBF and the non-coherent JT, with the final creature anticipated to be more passionate to channel qualms and synchronization errors than articulate JT.In proposed system Multimode transmission (MMT) policy, which enables us to recognize which CoMP scheme provides the largest throughput in each classification operating regime, depending on the standard SNR, the number of feedback bits, the delay on CSI, as well as on the number of antennas and users served. This system adaptively switches amongst dissimilar CoMP transmission modes to exploit the sum rate. Since different pathless attenuation is considered for the users and OCI is integrated in the model, several performance metrics cannot be consequent in closed-form. Use a instant identical technique to estimated the interfering distribution, which is given by the prejudiced sum of chi-squared random variables, by a Gamma distribution. Base station (BS) cooperation have raised considerable importance as a capable path to increase multi-cell ethereal competence and progress exposure concert of cell-edge users [1],[2].In excess of the lastly ears, network cooperation ,particularly for combined transmission ,synchronized beam forming, and synchronized preparation both in the uplink and downlink, has been comprehensively researched [3]–[5], and has transited beginning a speculative concept to a realistic technique [6]–[8]. In 3GPP consistency activities, BS co operation is referred to as synchronized multi-point transmission(CoMP) and is integrated in 4G wireless standards, such asLTE-Advanced.BS cooperative communication is used to exploit multicell interference, allowing for destructive occurrence claim that

Results in considerable sum rate gains. The main goal is to afford mobile users with homogeneous characteristic of service (QoS) in excess of the whole exposure area, even though the substantial constraints of stumpy customary power and high intervention at cell edges. Generally words and in ideal circumstances (e.g. perfect CSI) or with adequate CSI quality/resolution, the further BSs assist the a lesser amount of intrusion is generated, consequential in improved throughput gains at the disbursement of giving out data and organize in sequence between the implicated cells. CoMP can be in commonly classified into two categories. In the first type, only channel state information (CSI) is exchanged involving BSs, with synchronized Beam forming (CBF) being amid the most commonly used in the literature. That method does not deserve in extreme backhaul utilize and poses a lesser amount of rigorous harmonization necessities. In the second type, mutually information and control information are shared, incurring in huge exploit of radio and backhaul assets but as long as the likelihood for elevated gains by resources of joint transmission processing (JT) or network manifold input, multiple output (MIMO). That method stress for fast and consistent backhaul associations and imposes rigorous organization conditions. The considerable concert gains promised by CoMP techniques approach at the disbursement of CSI and seriously depend on the feedback excellence. Even though in occasion partition duplexing (TDD),CSI can be obtained by control reciprocity, in incidence partition duplexing (FDD) cellular systems, strait reciprocity cannot be oppressed and feedback has to be acquired during a finite rate repeal channel, which is topic to delay, channel inference errors, and quantization error. In actual systems, manifold steps have to be performed to attain the CSI, as follows. First, using lead symbols, the receiver has to estimation together channel's magnitude and direction (phase) on the downlink. This inference can be completed with virtual elevated correctness and the contact of this error is frequently disregarded in the prose. Second, the channel path has to be quantized with a fixed number of bits, creating inescapably a quantization error. The BS and the user be in agreement on a codebook, and the receiver.

II. OBJECTIVES

The objective of this paper was a).Base stations charity in the outline of wireless networking, mobile telephony, and additional wireless communications and: in surveying it is a receiver of GPS at a known location, whereas in wireless interactions it is a transceiver linking a amount of other devices to one a different and/or to a wider area. *b).Channel Sensing* attempts to find yet other transmission is in development before initiating a transmission attempts to perceive the occurrence of a transporter signal from additional node before struggling to transmit *c).Finding intersect COMP* Coordination between cells are measured by the similar base station of macro(where no backhaul connection is needed)*d).Finding Cell Edge* the cell edges are the most challenging. Not only is the signal lesser in power as of the space from the base station (eNB), but also interference levels from nearer eNBs are probable to be sophisticated as the UE will be nearer to them.

e).Receiving Multimode embodiments of an progressed Node B (eNB) and technique for coherent synchronized multipoint transmission with each CSI-RS feedback are generally described herein. In some embodiments, the eNB might constitute a initially collaborating point and a second cooperating point to jointly transmit a multi-node reference signal and channel-state information in scheduled resource elements of a resource block. The eNB may receive CSI reports as feedback from user equipment (UE).

III.SYSTEM MODEL

The Architecture of the system were Coordinate multiple transaction technique increasing the sum rate ,providing largest throughput in depending on the typical SNR, the quantity of feedback bits, the delay on CSI, as well as on the number of antennas and users served. It has been sketched below as a figure

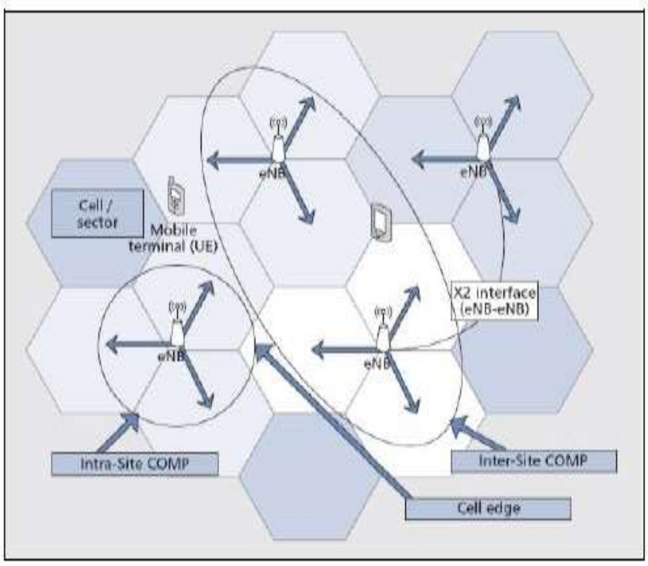

Fig 1.System architecture

The nodes are the cell edge, cell sector, intra site COMP, inter site COMP, mobile terminal and directions .First, confirm that you devour the accurate pattern for your paper size. This template has been tailored for output on the A4 paper size. Uncertainty you are exhausting US letter-sized paper, please close this file and download the file "MSW_USltr_format". The sum rate maximizing transmission scheme is SU-JT, while for larger standards of feedback bits, multiuser broadcast might flinch to kick in, whereas CBF is shown to be the least robust to imperfect CSI. The neat expressions allow us to reveal the sensitivity of CoMP transmission to the feedback inaccuracy in different SNR operating regimes. The main takeaway of this paper is that for small number of feedback bits (low feedback resolution) and moderate delay.

a).Base station

A Base station is a permanent communications location and is division of a network's wireless telephone system. It relays in sequence to and from a transmitting/receiving unit, such as a mobile phone. Frequently referred to while a cell site, a base station allows mobile phones to exertion within a local area, as extended as it is associated to a wireless service deliver .As mobile telephony the situation affords the contribution among mobile phones and the wider telephone network. In a computer network it is a transceiver performing as a router for computers in the network, perhaps linking them to a local area network and/or the internet. In conventional wireless communications it can pass on to the hub of a send off convoy such as a taxi or release fleet, the support of a TETRA network as used by government and emergency services or a CB shack

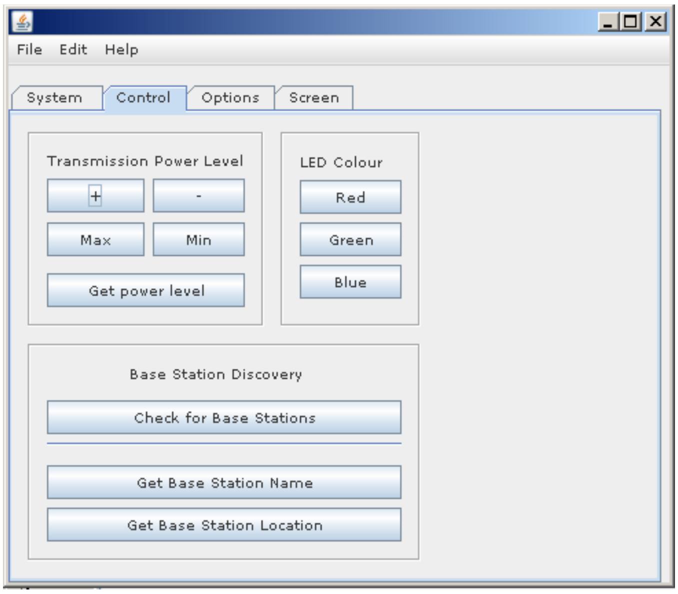

Fig 2.Base station block

b).*Channel Sensing*

Channel Sensing attempts to ascertain whether a more communication is in development earlier than initiating a communication. Channel allocation is an significant particularly in multihop networks where the channel accessibility depends on the place and the being there of most important user. The ideal channels were routinely segment in cognitive radio network can be considered on linear programming. That is, it tries to perceive the occurrence of a carrier signal from another node ahead of attempting to broadcast.

c).Finding intersect COMP

Finding intersect COMP Coordination among the cells (sectors) prohibited by the identical macro base station (where no backhaul connection is needed. Multilateration (MLAT) is a routing technique based on the amount of the *variation* in distance to two stations were also called as place of that broadcast signals as known times. Distinct sizes of entire expanse or perspective, measuring the difference in distance between two stations consequences in an unbounded quantity of places that content the measurement. When these feasible locations are plotted, they appearance a hyperbolic curve.

d).Finding Cell Edge

Coordinated Multipoint requires slam organization among a quantity of organically divided NBs. They dynamically synchronize to afford mutual arrangement and transmissions as fit as proving joint processing of the established signals. In this way a UE at the edge of a cell is capable to be served by two or more eNBs to progress signals reception / transmission and raise throughput mainly under cell edge conditions *.a).Joint processing: a).*Joint processing occurs wherever there is coordination among multiple entities - base stations - that are at the same time transmitting or receiving to or from UEs. *b).Coordinated scheduling or beam forming:* This frequently referred to as coordinated beam forming and coordinated scheduling is a variety of synchronization where a UE is transmitting with a particular communication or response socket - base station. Conversely the announcement is through with an exchange of organize among several corresponding individuals. To attain moreover of these ways, extremely exhaustive feedback is required on the channel properties in a fast routine so that the alterations can be completed. The supplementary resource is for close to the synchronization amongst the eNBs to facilitate the grouping of data or debauched switching of the cells.

The technique used for corresponding multipoint, CoMP is extremely dissimilar for the uplink and downlink. The features of consequence in a network of multi transmission connected to supplementary eNBs, while the handsets or UEs are separate elements.

IV.PRELIMINARIES

A).*Transmission Modes*

Two main cooperative schemes are investigated here: joint Transmission and coordinated beam forming. In JT, the coordinated BSsswap and distribute mutually data and control channel location information (CSI) and beneath perfect CSI, it can proffer spatial multiplexing of up to N_t and control gain of the sort of M $(N_t - U + 1)$. In CBF, single manage CSI is communal amid BSs to moderate the intervention inside the cooperative cluster. In theory, a spatial multiplexing increase of at mainly M can be achieved and the power increase is bargain (with deference to JT) to $N_t - M+1$.For description ease, mutually schemes are accessible beneath in the nonexistence of OCI, i.e. $M_{OCI} = 0$.Joint Transmission Mode (JT): In this broadcast mode, $1 \leq U \leq Nt$ users are served from every BS. Coordinated Beam forming (CBF): In this mode, BSs give out dissimilar users exploiting information of the manage channel information from nearest cells. Each BS uses the common CSI to give out its individual user hulling the intervention caused to users from adjacent cells

B. Imperfect CSI

Delay CSI feedback: The ordinary Gauss-Markov regular practice is worn to reading the consequence of CSI delay and to representation the sequential variation of the channel state. A block fading model [20] is implicit here, where **h** remnants regular above very border of time-span$T$ channel customs, and develops from edge to edge according to an ergo distinctive spatially white together Gaussian process.

***C.Quantized CSI*:** In FDD systems, every user intelligence backside to its BS channel direction information (CDI) for the channel slinking the user and its allocation and intrusive BSs.

This is through by means of a quantization codebook known at mutually sides.

D. Preliminaries

In this research, we consider as a different heterogeneous use case with incapable path loss and Rayleigh fading, hence we covenant with conditions (signal, interference, or OCI) concerning sums of χ^2 distributed random variables.

1) Exact Results: Let $A_i \sim Gamma\ (D_i, \theta_i)$ and $X = \sum_{i=1}^{M} A_i$. There are a variety of closed-form solutions for the distribution of X[23], [24]. In this paper, we arrangement with sums of Gamma variables with range parameters $D_i \in \mathbb{N}$ and dissimilar $\theta_i > 0$.

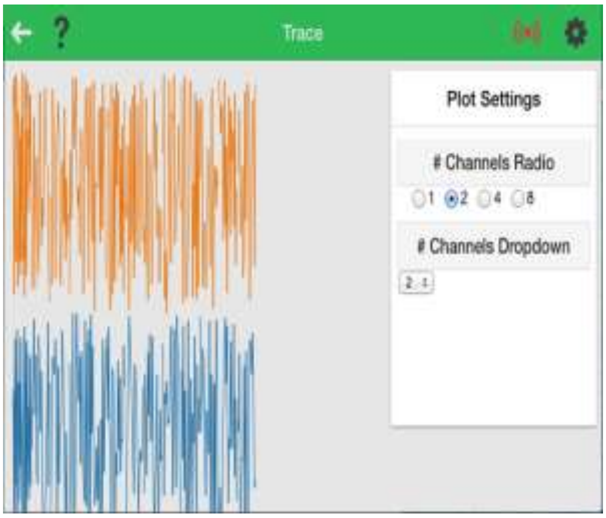

Fig 3.channel sensing

Are all included. First, we establish by deriving the delivery of the SINR, which serves as a structure block for conniving the standard rate.

IVAVERAGE ACHIEVABLE RATE ANALYSIS

A.Signal and Interference Distributions in JT

For the joint transmission scheme, we regard as two schemes, Explicitly *Coherent JT* (C-JT) and *Non-Coherent JT* (NC-JT).whereas the first plan assumes ideal synchronization and complete remuneration of the phase improbability, that is the many data symbols of each user are logically transmitted from the BSs, the second one assumes no segment adjustment. We describe the giving out of the established signal power in together cases, however in this paper we focal point on the concert of NC-JT. The explanation for this is that we consider here the effect of imperfect CSI, beneath which the NC-JT scheme is estimated to be additional robust to channel suspicions and synchronization errors than C-JT.*1) Desired Signal in NC-JT:* In NC-JT, the desired signal for the u-th user

For flanked by the rate realizable with ideal CSI and that with QD-CSI can be maintained.

at instantaneous n is received from M BSs without phase reparation

2) Desired Signal in C-JT: The desired signal for the u-thuser at immediate n is received from M BSs To the best of our information, there is no probable blocked form expression for the sharing of $S_{C-JT,u}$ as it is the square of a random variables of some whose distribution is known by the biased sum of autonomous Nakagami random variants. We will hence use a Gamma delivery where the estimation of the signal.

3) Interference Term: Beneath quantized and deferred CSI and $U > 1$, intervention is produced in the downlink transmission within the obliging cluster.

B.Signal and Interference Distributions in CBF

We regard as at this time the case of CBF and consequently where the signal was separated from the intrusion term.

1) Desired Signal: In CBF case, at the receiver the desired signal arrives from only one BS pleasing individual one path loss reduction coefficient $_{u,\ u}$ in front.

2) Interference Term: The interference in the CBF casing is the summing up of M−1 terms upcoming from M−1 BSs allocation one user every one.

C.The Effect of Other-Cell Interference

In view of M_{OCI} non-cooperative (interfering) cells and that each intrusive BS transmits one single tributary under the identical power constriction per BS, the OCI term is given by the prejudiced sum of M_{OCI} gamma dispersed random variables. Accurately, the path loss reduction is larger in the casing of OCI than the signals generated contained by the cooperative cells, as the users to provide are probable to be close to the cell edge.

D.General Expressions for Average Achievable Rate

In this section, we provide a common result for the standard achievable charge for a common appearance of SINR agreed as proportion of gamma distributions.

V. AVERAGE RATE DEGRADATION DUE TO QUANTIZATION AND DELAY

In Section III-D, we provided a common structure for analyzing the presentation of CoMP systems beneath deficient feedback and OCI. Although the presentation expressions are Known in closed-form, some are comparatively complex in more cases. For that, in this segment, we aim at deriving simpler approximations to compute the charge thrashing due to QD-CSI to explore the blow of quantization and holdup on the average achievable rate in CoMP systems. These approximations, even though individual coarser than the preceding one, detain the key system parameters that concern the sum-rate presentation, afford valuable insights, and are exposed to carry out adequately. Moreover, we demonstrate that if the scales of response rate at the nearest appropriate rate, similar of the signals are very un vary ingrate makeup

A).*Quantization*

Quantization is the practice of converting an incessant range of principles into a predetermined choice of discreet standards. This is a task of analog-to-digital converters, which make a sequence of digital values to describe the inventive analog signal. Quantization is apprehensive to a range of degrees in virtually all digital signals processing, as the improvement of representing a indication in digital structure in general involves rounding. Quantization also forms the interior of essentially all lossy compression algorithms. The feature between an input consequence and quantized rate is denoted to as quantization error

B).Delay

Computing beam forming vectors trusts on feedback for quantized channel state information of CSI from mobiles. Describe the constancy section for SDMA as the established of multi user packet-arrival amounts for which the steady-state queue lengths are predetermined. Given ideal CSI feedback and equivalent power allocation more than planned queues, the constancy section is proved to be a convex polytope having the consequent vertices. For several set of advent charge in the firmness region, multiuser queues are exposed to be steadied by a joint beam forming and queue manage policy that maximizes the going away-rate-weighted sum of queue lengths.

We examine here the regular rate offset when only deferred CSI is taken into account

C).Quantization and Delay Trade Off

We consider the zero-delay lossy transmission of a Gaussian random inconsistent. An attainable scheme for zero-delay transmission of an i.i.d. Gaussian basis over an preservative white Gaussian channel with no bandwidth constraint is introduced, and its energy-distortion presentation is analyzed. By the environment of the difficulty, one must pass on each foundation example individually but can exploit the channel considerably many times.

VI. ADAPTIVE MULTIMODE TRANSMISSION

In the previous average achievable rate analysis, we show that under imperfect CSI, there is a tradeoff between different CoMP transmission modes, i.e. CBF, SU-JT, and MU-JT, and the normal difficulty that arises is which CoMP method is most excellent to employ in each case. A crusty theoretical answer to this problem seems to be hard to give as the optimal CoMP scheme depends on several parameters, to be exact path loss, SNR operating regime, feedback resolution, delay, numeral of users, BSs, and antennas For that, we offer here a set of effortless convention, based on the closed-form expressions and we recommend an adaptive multimode transmission scheme. In this procedure, the attainable sum rate can be maximized by adaptively switching between dissimilar diffusion modes (SU-JT, MU-JT, and CBF) as are sources to equilibrium between power increase and spatial multiplexing Gain.

VII. NUMERICAL RESULTS

In this section, we corroborate the beyond routine analysis and the systematic terminology and approximations consequential in subdivision III-D. First, we corroborate the estimate for the attainable rate with equivalent path loss (homogeneous scenario).An analogous result is obtained for CBF, viewing the considerable collision of quantization and holdup on the sum rate, whereas OCI reduces the amount rate by approximately 50% in the elevated SNR regime. Besides, we learn when it is valuable from an standard sum rate position of view to achieve CoMP transmission as. The presentation of the dissimilar transmission modes compared to MRT for 2 BSs having 4 antennas. Dissimilar feedback resolution and delay ideals are evaluated as the SNR increases. Together users have been located in close proximity to the celledge.MU-JT is not exposed as its results are only marginally improved than CBF, which does not entail sharing data among BSs. In the low SNR establishment, MRT dominates both graphics. SU-JT is the finest form for low down feedback assertion, but the totaling of OCI gives to CBF a wider province over SU-JT. Lastly CBF provides superior performance in a large portion of both graphics but significant gains are seen only from the intermediate declaration, low delay and average SNR regimes united.

VIII. CONCLUSION

In this paper we investigate the Multimode transmission (MMT) policy, which enables us to identify which CoMP scheme provides the largest throughput in each system operating regime, depending on the number of feedback bits, the delay on CSI, as well as on the number of antennas and users served. This scheme adaptively switches values of feedback bits, multiuser transmission may start to kick in, whereas CBF is shown to be the least robust to imperfect CSI. The neat expressions allow us to reveal the sensitivity by CoMP transmission toward the feedback erroneousness in dissimilar SNR operating regimes. The main takeaway of this paper is that for small number of feedback bits (low feedback resolution) and moderate delay.

IX.REFERENCES

[1] S. Shamai and B. Zaidel, "Enhancing the cellular downlink capacity via Co-processing at the transmitting end," in *Proc. 53rd IEEE Veh. Technol. Conf.*, May 2001, pp. 1745–1749.

[2] G. J. Foschini, K. Karakayali, and R. A. Valenzuela, "Enormous spectral efficiency of isolated multiple antenna links emerges in a coordinated cellular network," *IEEE Proc. Commun.*, vol. 153, no. 4, pp. 548–555, Aug. 2006.

[3] P. Marsch and G. Fettweis, "A framework for optimizing the uplink performance of distributed antenna systems under a constrained backhaul," in *Proc. IEEE ICC*, Jun. 2007, pp. 975–979.

[4] P. Marsch and G. Fettweis, "On base station cooperation schemes for Downlink network MIMO under a constrained backhaul," in *Proc. IEEE GLOBECOM*, Nov. 30–Dec. 04 2008, pp. 1–6.

[5] P. Marsch and G. P. Fettweis, *Coordinated Multi-Point in Mobile Communications*. Cambridge, U.K.: Cambridge Univ. Press, 2011.

[6] V. Jungnickel *et al.*, "Coordinated multipoint trials in the downlink," in *Proc. GLOBECOM Workshops*, 2009, pp. 1–9.

[7] R. Irmer *et al.*, "Coordinated multipoint: Concepts performance and field trial results," *IEEE Commun. Mag.*, vol. 49, no. 2, pp. 102–

111, Feb. 2011[8] D. Lee *et al.*, “Coordinated multipoint transmission and reception in LTE-advanced: Deployment scenarios and operational challenges,” *IEEE Commun. Mag.*, vol. 50, no. 2, pp. 148–155, Feb. 2012.
[9] D. J. Love *et al.*, “An overview of limited feedback in wireless communication systems,” *IEEE J. Sel. Areas Commun.*, vol. 26, no. 8, pp. 1341–1365, Oct. 2008.
[10] N. Jindal, “MIMO broadcast channels with finite-rate feedback,” *IEEE Trans. Inf. Theory*, vol. 52, no. 11, pp. 5045–5060, Nov. 2006.
[11] J. Zhang, R.W. Heath, M. Kountouris, and J. G. Andrews, “Mode switching for the multi-antenna broadcast channel based on delay and channel quantization,” *EURASIP J. Adv. Signal Process. Multiuser MIMO Transmiss .Limited Feedback*, vol. 2009, pp. 1–29, Feb. 2009.
[12] J. Zhang, M. Kountouris, J. G. Andrews, and R. W. Heath, “Multi-mode transmission for the MIMO broadcast channel with imperfect channel state information,” *IEEE Trans. Commun.*, vol. 59, no. 3, pp. 803–814, Mar. 2011.
[13] M. Kobayashi, N. Jindal, and G. Caire, “Training and feedback optimization for multiuser MIMO downlink,” *IEEE Trans. Commun.*, vol. 59, no. 8, pp. 800–811, Aug. 2011.
[14] P. Marsch and G. Fettweis, “Uplink CoMP under a constrained backhaul and imperfect channel knowledge,” *IEEE Trans. Wireless Commun.*, vol. 10, no. 6, pp. 803–814, Jun. 2011.
[15] J. Hoydis, M. Kobayashi, and M. Debbah, “On optimal channel training for uplink network MIMO systems,” in *Proc. IEEE ICASSP*, 2011, pp. 3056–3059.
[16] R. Bhagavatula and R.W. Heath, Jr., “Adaptive limited feedback for sum rate maximizing beam forming in cooperative multicell systems,” *IEEE Trans. Signal Process.*, vol. 59, no. 2, pp. 800–811, Feb. 2011
[17] J. Zhang and J. G. Andrews, “Adaptive spatial inter-cell interference cancellation in multicell wireless networks,” *IEEE J. Sel. Areas Commun.*, vol. 28, no. 9, pp. 1455–1467, Dec. 2010.
[18] D. Jaramillo-Ramirez, M. Kountouris, and E. Hardouin, “Coordinated Multi-point transmission with quantized and delayed feedback,” in *Proc. IEEE GLOBECOM*, Dec. 2012, pp. 2391–2396.
[19] D. Jaramillo-Ramirez, M. Kountouris, and E. Hardouin, “Coordinated Multi-point transmission with imperfect channel knowledge and other cell Interference,” in *Proc. IEEE 23rd Int. Symp. PIMRC*, Sep. 2012, pp. 100–105.
[20] E. Biglieri, J. Proakis, and S. Shamai, “Fading channels: Information theoretic and communications aspects,” *IEEE Trans. Inf. Theory*, vol. 44,no. 6, pp. 2619–2692, Oct. 1998.
[21] K. K. Mukkavilli, A. Sabharwal, E. Erkip, and B. Aazhang, “On beam forming with finite rate feedback in multiple antenna systems,” *IEEE Trans. Inf. Theory*, vol. 49, no. 10, pp. 2563–2579, Oct. 2003.
[22] C. Au-Yeung and D. Love, “On the performance of random vector quantization limited feedback beam forming in a MISO system,” *IEEE Trans. Wireless Commun.*, vol. 6, no. 2, pp. 458–462, Feb. 2007.
[23] P. G. Moschopoulos, “The distribution of the sum of independent gamma random variables,” *Ann. Inst. Statist. Math.*, vol. 37, no. 1, pp. 541–544,1985.
[24] S. B. Provost, “On sums of independent gamma random variables,” *Statistics*, vol. 20, no. 4, pp. 583–591, 1989.
[25] C. A. Coelho and J. T. Mexia, “On the distribution of the product and Ratio of independent generalized Gamma-ratio random variables,” *Indian J. Statist.*, vol. 69, pp. 221–255, 2007.
[26] R. Tanbourgi, S. Singh, J. G. Andrews, and F. K. Jondral, “A tractable Model for non-coherent joint-transmission base station cooperation,” in *Proc. Inf. Theory*, 2013, pp. 1–14.
[27] D. Ben Cheikh, J.-M. Kelif, M. Coupechoux, and P. Godlewski, “Analytical joint processing multi-point cooperation performance in Rayleigh fading,” *IEEE Wireless Commun. Lett.*, vol. 1, no. 4, pp. 272–275 Aug. 2012.
[28] 3rd Generation Partnership Project. (2011, Dec.). Physical channels and modulation, Sophia-Antipolis Cedex, France, 3GPP TS 36.211 V10.4.0 (2011-12). [Online]. Available: http://www.3gpp.org
[29] V. Erceg, S. J. Fortune, J. Ling, A. J. Rustako, and R. A. Valenzuela, “Comparisons of a computer-based propagation prediction tool with experimental data collected in urban microcellular environments,” *IEEE J. Sel. Areas Commun.*, vol. 15, no. 4, pp. 677–684, May 1997.

