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Interference Aware Inter-Cell Rank Coordination for 5G Wide Area Networks

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***Abstract*—Multiple receive and transmit antennas can be used to improve the spectral efficiency by transmitting over multiple independent streams. In addition, multiple receive antennas facilitate interference suppression through the use of interference rejection combining receivers. Rank adaptation algorithms are aimed at balancing the trade-off between increasing the spatial gain and improving the interference resilience property. In this paper, we propose an inter-cell rank coordination scheme whereby a serving base station coordinates the preferred maximum interference rank with the dominant interfering BS. The propose scheme is computationally efficient and requires minimum control overhead. Matlab based system-level simulation results indicate around 65% gain in terms of the outage throughput with little impact on the peak user throughput.**

***Index Terms*—IRC receivers, MIMO, 5G, rank adaptation, ICIC.**

I. Introduction

Interference is a fundamental nature of wireless communication systems, more so in the case of dense networks with multiple receive and transmit antennas, collectively known as multiple input multiple output (MIMO) [1]. Similar to the fourth generation (4G) or long term evaluation (LTE) networks, efficient interference management techniques is therefore an important research challenge in the design of the fifth generation wireless system (5G). Traditionally, interference has been dealt with by coordinating users to orthogonalize their transmissions in time or frequency; or by increasing the transmission power and treating each other's interference as noise. Recently, the paradigm is shifting towards exploiting the knowledge and/or the structure of interference to improve the system performance.

Network-side interference coordination, such as Inter-Cell Interference Coordination (ICIC) [2] and enhanced ICIC (eICIC) [3] in LTE systems involves coordinated scheduling among interfering base stations (BS). The aim is to control the transmit power in certain time/frequency resources in order to to reduce the generated interference. At the receiver end, interference suppression receivers such as the interference rejection combining (IRC) receivers can be employed to actively suppress parts of the interference signal. Coordinated transmitter-end interference management techniques, such as transmit precoding [4] can also be applied to dynamically control the number of interfering streams.

MIMO transmission introduces spatial degrees of freedom (DoF) that allows transmission over multiple streams, also known as transmission ranks. The transmission rank has a great impact on the interference management aspect [5]. Increasing the rank can enhance the throughput through multiplexing gain at the expense of increased inter-cell interference (ICI). Alternately, transmitting with lower rank can improve the interference suppression capabilities of IRC receivers under certain circumstances, thereby improving the spectral efficiency of the overall network [6]. Rank adaptation, i.e., determining the number of independent transmitted streams or transmission rank, are aimed at balancing the tradeoff between increasing the spatial multiplexing gain by transmitting over multiple ranks, and improving the interference resilience by leaving more spatial DoFs for interference suppression at the IRC receiver end [7]–[9].

Several open-loop and closed-loop rank coordination algorithms for LTE and LTE-Advanced (LTE-A) systems are presented and numerically evaluated in [7]. Similarly, reference [8] proposes an algorithm to select the rank that maximizes the mutual information given a target Block Error Ratio under the assumption of having perfect channel state information (CSI) and no inter cell interference. A low complexity joint precoding matrix and rank selection algorithm for an LTE-A system is proposed in [10] that uses an average channel information across the entire system bandwidth. The proposed algorithm, which is also ICM-based, selects the rank that can deliver the highest throughput at the desired receiver by searching across the possible rank/precoding matrix combinations.

The above solutions do not consider the interference management aspect of rank coordination, and as such can be claimed to be *egoistic* rather than being *altruistic* or *interference-aware*. Such myopic transmission may result in poor overall system-level performance in dense network scenarios [11]. Coordination among cells is therefore necessary to better manage the interference [5], and becomes even more important in systems employing the IRC receivers, where the number of interfering streams have an impact on the interference suppression capabilities at interfered receivers [6].

We present an interference-aware rank coordination scheme for a 5G wide area network in this contribution with the objective of improving network performance in terms of the cell-edge and mean user throughput. The proposed coordination mechanism further has a multi-service integration aspect as it takes into account the service categories of the different users during the coordination phase. The generated inter-cell interference from the neighbouring dominant interferer BS is coordinated through the exchange of Xn messages. The proposed scheme requires minimum control overhead, and is found to offer attractive gains from system level simulation results. Though presented for the particular use case of 5G wide area networks, the proposed rank scheme is is applicable in other scenarios, e.g., 5G small cells.

The remainder of this paper is organized as follows: the system model is elaborated in Section II. Section III details the problem formulation while the proposed rank coordination mechanism is presented in Section IV. Example of a rank adaptation algorithm to be applied in the proposed rank coordination is presented in Section V, followed by results evaluating the performance of the proposed algorithms in Section VI. Finally, Section VII concludes the paper.

Notations: Matrices and vectors are respectively denoted by boldface symbols $\mathbf{H}$ (capital) and $\mathbf{h}$ (small letter). $\mathbf{I}$ denotes the identity matrix while $(\cdot)^H$ is the Hermitian operator. $\mathcal{CN}(\mu, \sigma^2)$ represents the complex Gaussian distribution with mean μ and variance σ^2.

II. System Model

Let us consider a multi user-MIMO (MU-MIMO) time division duplexed (TDD) system with a number of cells as shown in Fig. 1. We assume that the users within the same cell are scheduled in orthogonal narrowband resources, but are subject to inter-cell interference (ICI) on its allocated time-frequency slot from its neighbouring cells. The focus of this paper is in the downlink direction since it is often the limited link with respect to the interference. Nonetheless, the proposed framework can easily be extended to the uplink. The cells are assumed to be connected via the Xn interface.

All links in the network are assumed to have N transmit and M receive antennas. The transmitter-receiver pair in the j^{th} cell communicates by transmitting $d_j \leq \min(M, N)$ streams. Distributed coordination of the number transmitted streams, i.e., transmission rank, as an interference management scheme is discussed in this contribution. All cells are assumed to be time synchronized. The availability of local channel state information (CSI) is assumed. Moreover, information about the dominant interfering cell and the dominant interference ratio (DIR) as introduced in Section II-B are also considered available.

A. Signal Model

Let us consider the n^{th} stream of the j^{th} cell to be the generic desired signal. Hence the other streams from the same cell and that from the other cells constitute the interference signals. The baseband representation of the received signal per frequency sub-carrier, after transmission over a fading channel, can be expressed as

$$\mathbf{y}_{j,n} = \underbrace{\mathbf{h}_{j,n} x_{j,n}}_{\text{desired signal}} + \underbrace{\underbrace{\sum_{t \neq n, t=1}^{d_j} \mathbf{h}_{j,t} x_{j,t}}_{\text{intra-stream interf.}} + \underbrace{\sum_{k \neq j, k \in \mathcal{J}} \mathbf{H}_{jk} \mathbf{x}_k}_{\text{inter-cell interf.}} + \mathbf{z}_{j,n}}_{\text{sum interference plus noise vector } \mathbf{u_{j,n}}}, \tag{1}$$

where $\mathbf{h}_{j,t}(x_{j,t}) \forall t \in \{1, \ldots, d_j\}$ is the t^{th} column (element) of $\mathbf{H}_{jj}(\mathbf{x}_j)$; while $\mathbf{H}_{jk} \in \mathbb{C}^{M \times d_k}$ and $\mathbf{x}_k \in \mathbb{C}^{d_k} \forall j, k \in \mathcal{J} = \{1, \ldots, J\}$ are the complex channel gains between the receiver of cell j and the transmitter of cell k, and the transmitted symbols at cell k respectively. Note that, $\mathbf{H}_{jk}$ represents the equivalent channel gain after precoding. In order to focus our attention on the rank coordination problem, we consider a simple precoder in this work, where the transmission of the t^{th} rank is mapped directly to the t^{th} antenna, with equal transmit power across all the ranks. Note however that, once the rank is decided in a coordinated way, a suitable precoder can be selected from a predefined codebook individually at each cell, e.g. following the procedures defined in [12].

The total mean interference power experience by the receiver in cell j from all transmitting streams of cell k is σ^2_{jk}(hence, the mean interference power from each interfering stream is given by $\frac{\sigma^2_{jk}}{d_k}$). The vector $\mathbf{z}_{j,n} \in \mathbb{C}^M \sim \mathcal{CN}(0, \frac{1}{2}\mathbf{I}_M)$ represents the additive white circularly symmetric complex Gaussian noise. For the ease of presentation, we have defined the sum interference plus noise vector $\mathbf{u}_{j,n}$ in Eq. (1). All channel fading vectors are assumed to be independent and identically distributed (i.i.d.) following the Rayleigh fading distribution with unit variance.

The covariance matrix of the received signal at the desired receiver $\mathbf{y}_{j,n}$ is defined as $\mathbf{\Sigma}_y \triangleq \mathbb{E}[\mathbf{y}_{j,n}\mathbf{y}^H_{j,n}]$. By assuming the different transmitter sources to be mutually uncorrelated, $\mathbf{\Sigma}_y$ can be expressed as $\mathbf{\Sigma}_y = \sigma^2_{j,n}\mathbf{h}_{j,n}\mathbf{h}^H_{j,n} + \mathbf{\Sigma}_u$ [13], $\mathbf{\Sigma}_u$ is the covariance matrix of $\mathbf{u}$ as given by $\mathbf{\Sigma}_u = \mathbf{\Sigma} + \mathbf{I}_M$, where $\mathbf{\Sigma}$ is the interference covariance matrix defined as $\mathbf{\Sigma} \triangleq \mathbf{H}\mathbf{D}\mathbf{H}^H$ [13]. Here $\mathbf{D}$ is a $K-$dimensional diagonal matrix whose k^{th} diagonal element represent the mean interference power of the respective interference stream, and $K = \sum_{j \in \mathcal{J}} d_j - 1$. The combined channel matrix $\mathbf{H}_j \in \mathbb{C}^{M \times K}$ is the column-wise concatenation of all intra–stream and inter-cell interference channel gain vectors.

B. 5G Specific System Model Considerations

An interference-aware rank coordination mechanism for MIMO transmission scheme for a 5G wide area network is proposed in this contribution. A 5G-optimized system with in built support for the IRC receiver is specifically considered. The physical layer aspects of 5G new radio, and in particular, the frame structure as specified by the technical report [14] are assumed. It is assumed that uplink (UL) and downlink (DL) have symmetric frame format. The frame structure features a control part time separated by a data

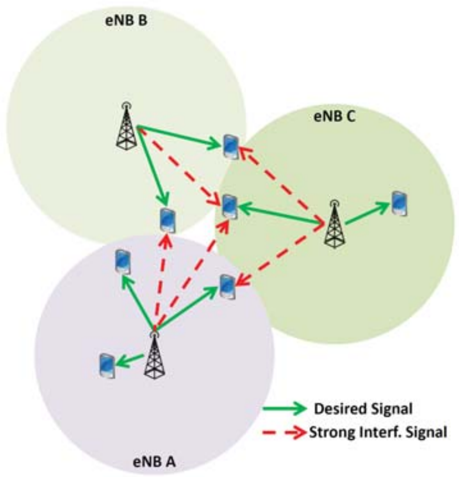

Fig. 1. Schematic of the considered 5G wide area system model.

part. The first symbol of the data part is dedicated to the Demodulation Reference Sequences (DMRS) for enabling channel estimation at the receiver, thereby facilitating the use of IRC receivers. Applications of such a 5G optimized frame structure in the context of a small cell centimetre wave concept is also detailed in [15].

Dominant Interference Ratio: The dominant interference ratio (DIR) is defined as the ratio of the dominant interference power over the rest of the interference power. Let $\boldsymbol{\Upsilon}$ be the vector representing the interference powers at a receiver of interest from different BSs. The DIR is then defined as

$$DIR = \frac{\max(\boldsymbol{\Upsilon})}{\sum(\boldsymbol{\Upsilon}) - \max(\boldsymbol{\Upsilon})}. \quad (2)$$

The dominant interfering cell ID can also be captured, and included as part of the DIR info. It has been shown in the literature that controlling the dominant interference power can generally result in significant performance improvement [16]. Though DIR info is not standardized as part of the LTE physical layer measurements as of yet, it is therefore likely to be a part of the 5G standard.

III. Problem Formulation

Maximizing the sum rate across all cells in an MU-MIMO interference channel is a well known challenging problem [17]. A centralized brute-force (BF) exhaustive search approach to addressing this problem requires a prohibitive amount of computational complexity $\left(\mathrm{O}\left(J^M\right)\right)$ and signalling overhead even for moderate network sizes [17]. Sub-optimal approaches include centralized or distributed coordinated algorithms usually involving message exchange mechanism. For example, the game-theoretic concept of 'pricing as a control parameter' has been used to force coexisting users to behave altruistically and to measure individual user's contribution to the system throughput utility in a more comprehensive way in. However, such techniques require exchanging control messages among the users, which may not always be feasible.

We consider a different approach in this contribution, and investigate inter-cell coordinated rank adaptation in this contribution. In particular, the following challenges related to rank coordination in 5G wide area MU-MIMO networks are addressed: practical coordination schemes should require nominal coordination be free of high computational complexity so that it can be easily implemented, and such methods should not require full channel state information (CSI) availability as this can be especially challenging. The proposed coordination is carried out by exchanging Xn messages among the serving and the interfered BSs and targets users scheduled over relatively longer durations.

IV. Inter-Cell Rank Coordination Procedures

In the following, the proposed interference aware inter-cell rank coordination (ICRC) mechanism is presented in details. A schematic of the related flow chart is shown in Figure 2.

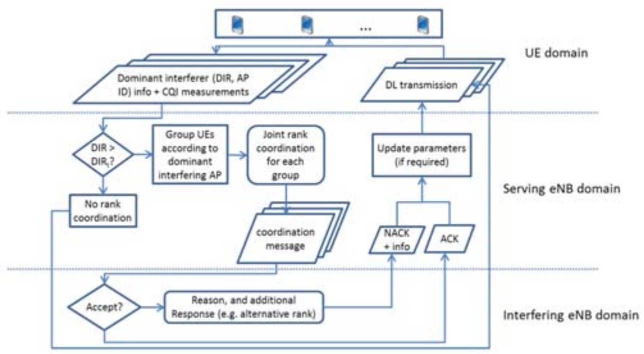

Fig. 2. Flowchart of Message Flow with multiple UEs: Downlink case.

The UEs report the DIR information along with channel quality indicator (CQI) message to the serving BS. The DIR information is calculated according to Eq. (2), and includes information about the relative power of the strongest interferer and its ID. The serving BS invokes ICRC if the DIR is above a certain pre-specified threshold. A threshold value of $2-6$ dB is found to be a good choice.

The UEs selected for ICRC are then grouped according the dominant interfering cell. In this way, the rank coordination can be more efficient, and will not result in conflicting coordination requests from the same BS. The serving BS decides what will be the transmission rank for each of the UEs in each group, along with the maximum interference rank it is willing to accept. Moreover, a priority is also set for each of the coordination message.

A priori knowledge of the UEs target throughput (i.e. equivalent to target SINR), service class, and the UEs receiver type and number of receive antennas, are used as an input to the algorithm deciding own transmission rank and the desired interference rank. The ranks are chosen so as to satisfy the UEs target throughput (or equivalently SINR) with high probability, as specified by the target outage probability. The proposed coordination scheme is not bound to any specific rank adaptation algorithm. However, a novel algorithm for selecting the desired and the interference rank is discussed in Section V.

The priority measure $(0 - 1$:low-high) indicates the importance of the requested coordination. A strong priority requires the interfering BS to honour the rank coordination request with higher importance, and vice versa. The priority calculation takes the service group and other transmission parameters into account. For example, an ultra-reliable low latency communication (URLLC) service message is expected to be translated to a high priority. On the other hand, a massive machine type communication (mMTC) service message will most likely be associated with a lower priority. Additional transmission state information is also considered when calculating the priority. For example, a transmission with a higher Hybrid Automatic Repeat reQuest (HARQ) counter, i.e., messages that are being repeated, will have a higher priority than a similar message being transmitted for the first time.

The number of high priority coordination messages will be controlled in order to ensure fairness and restrict a particular BS from overwhelming its neighbors with high priority rank coordination messages. Our proposal is to restrict the sum of the priority levels (note that, priority measure is a numerical value ranging from 0 to 1) to be at most a certain percentage (say, 30%) of the total number of coordination messages. The exact value of such a percentage is to be optimized based on the network operating parameters.

The serving BS sends the desired rank message to the respective interfering BSs, along with the priority information via the Xn interface. The desired rank message is indicated as the maximum allowable transmission rank for a given (set of) resource blocks (RB).

Since the serving BS indicates the preferred maximum allowed interference rank, the interference BS(s) is(are) free to independently adjust the transmission rank up to that maximum on a per-transmission time interval (TTI) basis. This essentially means that the *max rank* is coordinated, and updated on a semi-fast basis, whereas the actual transmission rank is still adjusted on a per-TTI basis (up to the max allowed rank). The rate for "semi-fast MAX rank updates will depend on the latency/periodicity of the Xn message exchange.

The interfering BS has the choice of either accepting or rejecting the requested rank limitation. This is partly determined by the priority level, and its own resource allocation/scheduling demands. In the case of rejection, the interfering BS has the option to provide additional response such as the reason for rejection, alternate RBs with the requested rank limitation etc. Moreover, the interfering BS can improve the efficiency by combining the coordination messages from several neighboring BSs. For example, suppose BS A and B requests BS C to have a max rank 2 transmissions on RB 1 and 2, respectively. BS C can reject the request of BS B, and instead inform it that BS C will be limiting the transmission rank on RB 1 to max 2, and that BS B can schedule its corresponding UE(s) on RB 1 instead of RB 2.

The serving BS can adjust its transmission parameters according to the feedback message from the interfering BSs. Such update can include re-scheduling the users, re-adjusting the transmission parameters, or re-adapting the transmission rank with respect to the feed-back message.

The ICRC occurs over a longer time frames than the transmission time interval (TTI), which in 5G systems has a minimum duration of $0.125ms$. ICIC adaptation in LTE occurs over a time frame of every 20 ms. In the case of 5G the ICRC duration would ideally be in the range of a $2-5$ ms. Considering such a granularity, ICRC is particularly suitable for extended mobile broadband (eMBB) type heavy payload traffic spanning over multiple TTIs.

The message flow between a single UE and the serving BS, and between the serving and interfering BSs is shown in Figure 3.

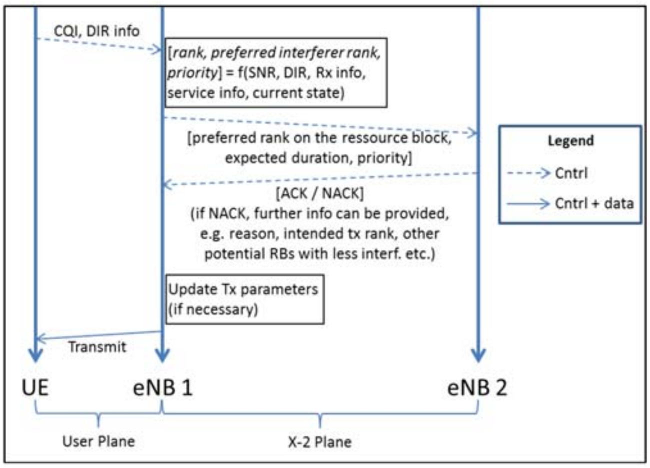

Fig. 3. Message Flow Diagram of a single UE: Downlink case.

V. Dominant Interferer-Aware Rank Adaptation Algorithm

An important aspect of the proposed rank coordination mechanism is the calculation of the desired interferer rank. Rank coordination between the interfered and the interferer cells is not bound to any specific rank adaptation algorithm. Existing interfere aware methods, such as those proposed in [5] can be used. Nonetheless, a simple rank dominant interferer aware rank adaptation method specifically designed for the IRC receiver is proposed in this section.

A. Post-IRC SINR Estimation

Considering the IRC receiver, the desired symbol is estimated as $\hat{x}_{j,n} = \mathbf{w}_{j,n}^H \mathbf{y}_{j,n}$ [13], where $\mathbf{w}_{j,n} = \sigma_{j,n}^2 \mathbf{\Sigma}_y^{-1} \mathbf{h}_{j,n}$ is the linear IRC receiver structure. The post-IRC SINR of the desired signal can then be expressed as [13]

$$\gamma_{j,n} = \sigma_{j,n}^2 \mathbf{h}_{j,n}^H \left(\mathbf{\Sigma} + \mathbf{I}_M\right)^{-1} \mathbf{h}_{j,n}. \quad (3)$$

It can be observed from Eq. (3) that an accurate estimation of the interference covariance matrix (ICM) is required to estimate the post-IRC SINR. However, the ICM is a function of the desired, and the interferer ranks; and can only be estimated after the actual data transmission. In order to circumvent such a *chicken and egg* issue, we propose to circumvents the requisite of relying on the ICM for estimating the SINR. Instead, we derive an estimate of the post-IRC SINR as a function of the desired signal strength and the dominant interferer power using random matrix theory (RMT) results as detailed in [18]. The post-IRC SINR expression is summarized here for completeness.

Let us consider the eigen-value decomposition (EVD) of the interference covariance matrix $\mathbf{\Sigma}$ in Eq. (3) as given by $\mathbf{\Sigma} = \mathbf{T}\mathbf{\Lambda}\mathbf{T}^H$. The $M-$dimensional diagonal matrix $\mathbf{\Lambda} = \text{Diag}\left(\lambda_1, \lambda_2, \ldots, \lambda_M\right)$ contains the eigenvalues of $\mathbf{\Sigma}$, while the m^{th} column of the unitary matrix $\mathbf{T}$ represents the eigenvector corresponding to the eigenvalue λ_m. From the EVD of $\mathbf{\Sigma}$, and after some algebraic manipulations, the instantaneous SINR in Eq. (3) can be expressed as [13]

$$\gamma_{j,n} = \sigma_{j,n}^2 \sum_{m=1}^{M} \frac{|g_m|^2}{\lambda_m + 1}, \quad (4)$$

where g_m is its m^{th} element of the vector $\mathbf{g}_{j,n} \triangleq \mathbf{T}^H \mathbf{h}_{j,n}$. The m^{th} column of the unitary matrix $\mathbf{T}$ represents the eigenvector corresponding to λ_m, the m^{th} eigenvalue of the ICM $\mathbf{\Sigma}$. Since $\mathbf{T}$ is unitary, $\mathbf{g}_{j,n}$ and $\mathbf{h}_{j,n}$ have the same statistical properties, i.e. $\mathbf{g}_{j,n} \sim \mathcal{CN}(0, \frac{1}{2})$. Using results from random matrix theory to analyse the asymptotic behaviour of the eigenvalues of the ICM $\mathbf{\Sigma}$ appearing in Eq. (3), it was proposed in [18] that the post-IRC SINR given by (3) can be approximated by its mean as

$$\gamma_{j,n} \approx \bar{\gamma}_{j,n} = \sigma_{j,n}^2 \tilde{\gamma}, \quad (5)$$

where $\tilde{\gamma}$ is the only positive root of the polynomial equation

$$\beta_j + \sum_{k=1, k\neq j}^{J} \frac{\sigma_{jk}^2/M}{1 + \sigma_{jk}^2/d_k \tilde{\gamma}} - \frac{1}{\tilde{\gamma}} + 1 = 0, \quad (6)$$

where $\beta_j = \frac{\sigma_{j,n}^2 d_j/M}{1+\sigma_{j,n}^2 \tilde{\gamma}}$ for $d_j > 1$, and $\beta_j = 0$ for $d_j = 1$.

Eq. (6) can be easily solved using any suitable mathematical computational software, such as Matlab.

B. Proposed Rank Adaptation Algorithm

The post IRC SINR for all possible combinations of the desired and the dominant interferer rank tuples (d_i, d_j) can be calculated using Eq. (5). For a given target SINR γ_t, the desired transmission rank $d_i^\star$ is the minimum d_i that can support γ_t. Similarly, the desired dominant interferer rank $d_j^\star$ is the maximum d_j that can support γ_t. If no combinations of the rank tuples result in meeting the estimated SINR, then the combination resulting in the highest SINR is selected as the desired rank tuple.

VI. Performance Evaluation of the Proposed Inter-Cell Rank Coordination

The performance of the proposed ICRC scheme in terms of the throughput per user (in Mbps) is numerically presented in this section and compared against baseline non-coordinated schemes. The performance is evaluated using Matlab based system level simulation. The scenario involves seven cells in a hexagonal grid, with each node equipped with M antennas. Both BSs and UEs are assumed to have the same number of antennas. The users are distributed randomly across the cell. Different values of the DIR threshold are presented. Details of the simulation environment are presented in Table I.

TABLE I
Basic Simulation Parameters

Simulation Parameter	Value
Cell Type	Macro cells in hexagonal grid
Inter Site Distance	500 (m)
Nr. of Cells	7
Carrier frequency (f_c)	2 GHz
Bandwidth	10 MHz
Traffic Profile	Downlink, Full Buffer
Nr. of Transmit/Receive antennas	M
Path Loss Model	Winner II
Shadowing standard deviation	4 dB
Maximum Doppler Frequency	6 Hz
Thermal Noise density	-174 dBm/Hz
Noise Figure	6 dB
Total transmit power	20 dBm

Figure 4 presents the cumulative density function (CDF) of the user throughput with $M = 8$ antennas per node for a DIR threshold value of 5 dB. Therefore, ICRC is triggered when a particular UE detects a strong interferer with DIR exceeding the DIR threshold. Only the downlink scenario is considered. From the obtained preliminary simulation results, we can observe an outage (i.e. 5-percentile), mean TP gain, and a peak TP gain (i.e., 95-percentile) of around $65\%, 30\%$ and 6% respectively.

The TP gains for different DIR threshold values with $M = 4$ are presented in Table II. The performance gains are of the same order for DIR threshold of 2 and 5 dB. However, the merits of the proposed ICRC scheme are lost when the threshold is raised to 10 dB. Note that the slight loss in performance can be attributed to statistical randomness in simulations. It is however interesting to note that, a slight loss in the peak TP, in the order of $6 \sim 7\%$, is observed with the proposed scheme. This is mainly due to having fewer antennas ($M = 4$ in this case), and the limitation imposed in terms of the constrained transmission rank at the interfering cells, which could otherwise benefit from higher transmission ranks under favorable traffic conditions.

VII. Conclusion

Inter-cell interference management in a dense multi cell environment is essential to improve the overall network per-

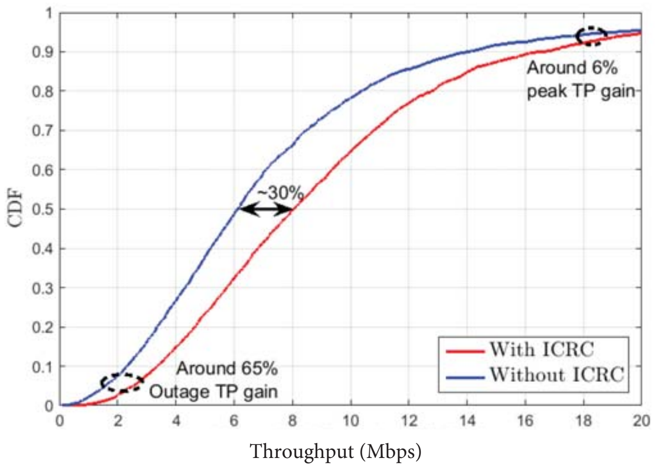

Fig. 4. CDF of the per user TP with the proposed ICRC scheme for a seven cell network with M = 8.

TABLE II
PROPOSED ICRC TP GAINS AGAINST BASELINE NON-ICRC SCHEME FOR M = 4 WITH DIFFERENT DIR THRESHOLD

	DIR Threshold (dB)		
Throughput Gain	2	5	10
Outage	57%	60%	−3%
Media	31%	32%	−1%
Peak	−7%	−6%	−1%

formance. Controlling the number of transmission streams, i.e. the transmission rank in a distributed manner is a relatively simple, yet effective, interference management technique. Coordination of the transmission rank among interfering cells is therefore necessary, especially considering the IRC receiver that can potentially suppress a number of dominant interfering streams.

A practical inter-cell rank coordination mechanism considering the dominant interference ratio is introduced in this paper. The proposed scheme uses tools from random matrix theory to estimate the post IRC SINR, which is then used to calculate the desired self and interferer rank. A Xn link based protocol is then suggested to coordinate the transmission with the dominant interferer. The proposal further includes a priority information field to incorporate the different 5G service classes, namely eMBB, URLLC and mMTC; and a conflict resolution mechanism to address potentially conflicting rank requests. Monte-Carlo based performance evaluation demonstrates up to $\sim 65\%$ outage TP gain with the proposed coordination scheme over non-coordinated transmission.

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