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Optimized Load Sharing using Enhanced Genetic Algorithm in LTE Network

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ABSTRACT: Femtocells are developed as a better solution to reduce the intramural coverage holes and to handle augmenting traffic needs in Long Term Evolution (LTE) networks. ‘Cell range Expansion’ (CRE) is the significant component of LTE advanced, where low-power nodes in a diversified network increase their coverage area. Therefore, neighbor cells offload to specific users. The total expansion, however, varies from one cell to another contingent on the locality of the low-power node concerning the cell load and the neighbor cells. In that circumstance, issues like sharing the nodes equally amongst the lower-power nodes (femtocells) and the macrocells arises. The paper proposes a technique for sharing loads of femtocells with the macrocells utilizing cell range expansion. The above technique augments the ‘Almost Blank Subframe’ (ABS) and cell range with the help of Enhanced Genetic Algorithm (EGA) for effectual load sharing betwixt the femtocells and the macrocells. The equal sharing of loads is reliant on the fitness function which relies on Jain’s Fairness Index (JFI). It is said that the loads are equally shared as the JFI value is 1. The solution acquired from EGA is utilized in sharing the loads equally within a macro-femto network. Experimental outcomes exhibit that the technique which is proposed gives promising results in equal sharing of loads and outperforms other conventional techniques.

KEYWORDS: Range Expansion, Long Term Evolution, Almost Blank Subframes, Genetic Algorithm, Jain’s Fairness Index.

I. INTRODUCTION

A massive commercial success and technological progress were arisen in a wireless network in the previous two epochs. In the forthcoming years, the normal cellular structures are not adequate to acquire the traffic needs. Therefore, ‘3G Partnership Project’ (3GPP) LTE is proposed to establish a novel technology component that meets the requisites of data demand in future [1].

The regulating 4G augments the capacity of radio mobile system in existing cellular networks and compensates the service requisites for prospective user demand, is regarded as LTE [2]. All LTE’s inclusive nature makes it perfect for the incorporation of diverse mobile communication technologies. However, augmenting network traffic raises the demand for limited network resources and energy usage [3].

To meet an anticipated noteworthy growth in mobile data and to expand the network capacity and performance, the migration from traditional homogeneous Macro only networks to a more diverse heterogeneous network is necessary. Cellular networks are highly heterogeneous in two diverse dimensions [4]. Firstly, in the traffic supply dimension and secondly, from the traffic demand side.

3GPP is investigating the real deployments of lower-power base station (BS) and relay nodes in an overlay integrated with the macro and microcellular network as a way to augment system capacity and ameliorate network coverage within the LTE. It defines a network formed by macro, pico, micro, together with femtocells normally as a heterogeneous network [5]. The traditional macro eNBs have limitations in intramural coverage and throughput of hot spots. To increase the indoor coverage and the throughput of hot spots, possible solutions in HetNets (in which femtoeNBs, macro eNBs, relay eNBs and picoeNBs are possibly included) were broadly investigated [6].

The data traffic originates from intramural environments like homes or offices. Consequently, the improvement in the intramural coverage and entire network capacity, at a rational cost is accomplished by cellular

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operators [7]. This issue was previously resolved by raising the total of BSs, but such tactic is never possible in future as there is certainly no scalability. Immense femtocell disposition is proposed to face intramural traffic [8]. Femtocells are an auspicious solution for establishing the high intramural capacity and coverage, which assist to diminish congestion issues in overladen macrocells. Femtocells are less-power BSs utilizing cellular technology on licensed spectrum delivering capacity and coverage intramurals through internet-grade backhaul under operator management [9].

Small cells proffer added capacity yet they bring new difficulties to resource and interference management. However, strong structural isolation and less femtocell transmission power due to barriers discharge the interference issue betwixt extramural macro and intramural femto layer also, betwixt diverse femtos [10]. CRE association biases handoff boundaries in favor of small cells so that it expands the service area of small cells. CRE mitigate the interference and enhance the LB (load balancing) in the network [11].

The EGA is utilized to enhance the Femtocell extend and macrocell ABS rate. The finest fitness value is attained and sorted by enhancing the ABS and Cell Range for all the populace. Now, as of the sorted list, the best 50% of the fitness is selected, and these go through mutation along with crossover. Then, the solutions are refreshed which offers the end solution. For utilizing this streamlining computation, the clients in the cell are effectually allocated with no aggravation.

The draft structure of this paper is systematized as Section 2 surveys the associated works regarding the proposed method. In sections 3, a brief discussion about the proposed methodology is presented, section 4 analysis the Investigational outcome and section 5 deduces the paper.

II. LITERATURE REVIEW

The related researches that are with regard to the proposed work are elaborated in this section as described below.

Raman Paranjape and Diego Castro-Hernandez [12] implemented a contrastive analysis of the performance of three LB algorithms. They estimated the effectiveness of those algorithms in view of a typical 2-tier HetNet deployment subject to a realistic traffic distribution and considering the influences of user mobility on the LB process. Those three LB algorithms were proffered with similar performance in concerning fairness in the allocation of the load and macrocell offloading. Normally, an average of one-third of the macro cell load gets offloaded to microcells that result in a reasonable allocation of the demanded load across several BSs. Consequently, high data rates were attained. But, the improvements in spectral efficacy weren’t as large as conveyed in preceding studies, where steady-state assessments were made.

Sonia et. al [13] suggested an LB strategy centered on traffic scheduling. Several Traffic scheduling algorithms were considered earlier to allow shared resources amongst users to utilize the LTE systems’ performance in an effectual manner. Three sorts of algorithms contrasted, concerning their respective performance were FCFS (‘first come first serve’), RR (‘round robin’) and hybrid algorithm which were the mixture of FCFS and RR in extremes conditions. Hybrid algorithm outcomes were signified as an edge over the FCFS and RR algorithm. The error rate was decreased and job scheduling competency was increased in hybrid scheduling algorithm. The number and size of packets gave diminished symbol error rate (SER) on considering SNR (signal to noise ratio) by executing the suggested algorithm. The conferred scheduling algorithms’ performance was dignified reliant on SNR and SER.

AleksandarIchkovet. al [14]targeted a 2-tier heterogeneous centered LTE network which comprised, femto and macro tiers. It presented arbitrary assignment of resources on the femto, a new active offloading system in the user association stage and in a new femto tier access control. System level simulation outcomes concerning rate distribution, i.e. the users attained certain rate in the system, displayed that an optimum RRM strategy could be intended for diversified network situations. The suggested active offloading system in the association stage enhanced the congested networks’ performance by effectually utilizing the prevailing femto tier based resources. Moreover, the presented femto hybrid access permitted 20 times maximal data rates for the licensed users, compared to the non-licensed users in the network. Operators assured minimum average rates and privileged access for subscribers, proffering a chance for employment of richer and newer services and utilized it to motivate the utilization of femtocells, specifically in intramural environments of homes, offices etc.

Louis Christodoulou et. al [15] presented a Hybrid Unicast-Broadcast Synchronization (HUBS) structure to concurrently convey multiple stream contents. It was perceived that the HUBS structure was established to function within the limitations imposed by the LTE specifications. Performance assessment of this structure was performed through the simulation of possible future situations. The suggested structure formed a “HUBS group” that observes the radio bearer queues to form a time lead or lag betwixt unicast and broadcast streams. Since unicast and broadcast shares particularly the same radio resources, the total subframes assigned to the broadcast transmission were then dynamically enlarged or diminished to limit the average lead/lag time offset betwixt the streams. Dynamic allocation displayed developments for every service through the cell, as keeping the streams synchronized despite maximal user loading.

Chongdeuk Lee [16] suggested a combined control structure centered on power control and assignment of resources for D2D with LTE networks. To do the suggested results, it employed the object SINR (‘signal to interference and noise ratio’) and concrete feedback SINR to alter dynamic power, assured that the receiver retrieves the signal well, and also prevented the sender from wasting power or from interrupting other devices. This study concentrated on D2D communications, with regard to the cellular communications to diminish the interferences. Consequently, considering RA (resource allocation), cellular communications utilized RBs (resource blocks) first, then D2D communications dissemination and utilized the lasting RBs.

III. ENHANCED GENETIC ALGORITHM (EGA)

The heterogeneity in cellular networks that encompasses several BSs enforces new difficulties in a deployment of a forthcoming generation of cellular networks and network planning. The dealing of resources as prevailing dynamic sharing fixes the whole network efficiency and capacity. The proffered paper proposes a technique for sharing loads of femtocells with the macrocells utilizing CRE. The above technique augments the ABS and cell range with the assistance of EGA for effectual load sharing betwixt the femto and the macrocells. Firstly, a network is built by generating hexagonal sectors which are the macrocells and next femtocells are positioned inside the macrocells betwixt certain distances and then the users are generated inside the cells. Now, optimization of parameters as ABS and cell range is done utilizing EGA. Finally, the solution attained from EGA is utilized in sharing the loads equally within a macro-femto network.

3.1 Network Layout

The network signifies a heterogeneous network encompassing 2 network nodes, macro and femto BSs. The network possesses four macrocell type BSs where each one positioned in the hexagonal sectors. Each macrocell comprises of two femtocells, which is a minor, lower-power cellular BS called Femto BSs. A single macro cell is detached as of the other macrocell at 400 m distance. The femtocells existing inside the macrocell are located at 100 m distance as of the macrocell. In this network layout, it possesses 2 femtocells per macro and hence one femtocell is separated from the other at 50 m distance. This network possesses three users, namely, Macro Users (MUs), Range Expansion (RE) users, in addition, FUs (Femto users). The macrocell range is 94 dBm whilst the femtocell range is 55 dBm. The total users for each macrocell are 40.

3.2 Cell Range Expansion

CRE extends the coverage region of minor cells to maximize the traffic offloaded as of the macro-cell. This is performed by changing the cell selections criterion to include the cell selections offset. In LTE networks, the serving cell selection criteria are typically ABS and Cell Range (CR). Adding cell selections offset to cell selectionscriterion diminishes the downlink/uplink coverage asymmetrically. Offloading MUs to femtocells free the macrocell resources but it happens at the price of the FUs. The bigger the CSO, further MUs get added to the femtocell and the higher the throughput loss for the prevailing femtocell users. Yet, the recently added users see an enhancement in their throughput specifically if they were on the macrocell’s edge. In this proposed work, it is presumed that the macrocells do not display any RE, whereas femtocells undergo RE. On expanding the femtocells’ range, the users assisted by macrocells becomes the femtocells’ range. Therefore, sharing of loads equally amongst the cells gets critical. The user in the extended cell arena, where the power retrieved as of the macro type BS is much higher considering the power retrieved from femto BS, which results in grave interference as of the macro type BS. To lessen the effects of interference connected with CRE, ABS approach is utilized.

3.3 Load Sharing using Almost Blank Subframe

The sharing of loads betwixt macro and femtocells is managed using a ‘Time Division Multiplexing’ (TDM) known as ABS. In particular, the transmit data power on certain subframes of the macro cell’s radio frame is muted to reduce interference on implicated small cells like femtocells. Such sub-frames are named as ABSsince the transmission power is muted on the resource fundamentals of the data channel, but not on other necessary control and reference signals resource elements. The fundamental idea is to have some subframes during which the macrocells is not permitted to transmit data allowing the range expansion of FUs, who is suffering from interference from the macrocell transmission, to transmit with better conditions. To leverage ABS-based technique, the ABS design at macrocells gets exchanged with the femtocells in coordination. Femtocellsmake the most of the opportunity of reduced interference by scheduling users in range expansion on ABSs.

The absolute blank subframe is utilized in two cases. In the initial case, the femtocell’s range is extended within the macrocell and in the next case; the femtocell’s range is extended to the nearby macrocell so that the femtocell is in a condition to assist the user of the nearby macrocell.

3.4 Optimization using Enhanced Genetic Algorithm

‘Genetic Algorithm’ (GA) is stimulated by the mechanism called natural selection, which is a biological process where the stronger ones are the winners in a challenging environment. It supposed that the solution for a provided issue is an individual and is signified by parameters. Those parameters are considered as the chromosomal genes; it is then structured and signified by some parameters. GA searches parallel from a population points. Therefore, it possesses the capability to elude trapping on local optimum solution, which searches from one point. Thus, a GA to define the finest ABS design that upsurges the network’s performance is executed. Fig 3.1 demonstrates the process flow of the proposed work.

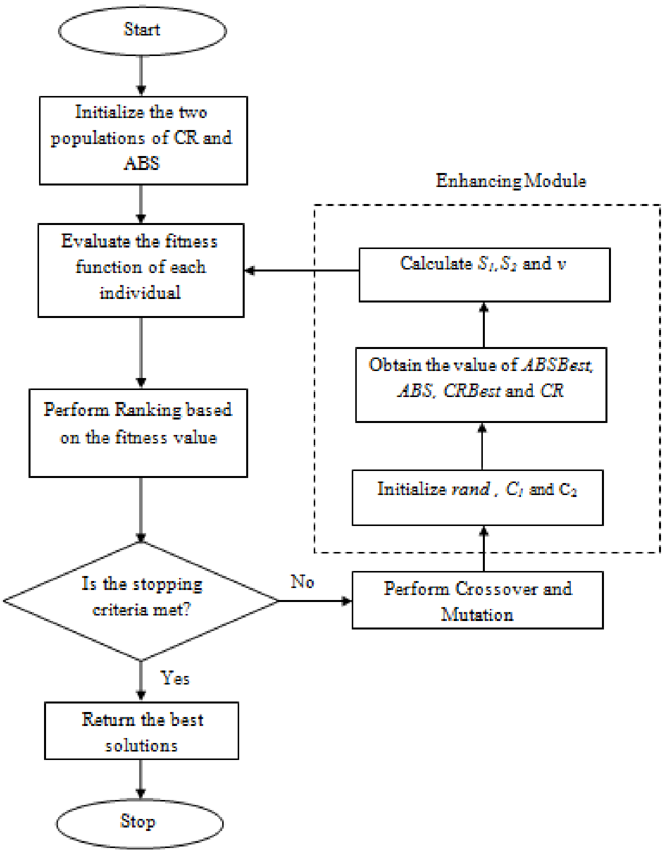

Figure 3.1 Flow Diagram of the proposed work.

To assess individuals' performance of a given population, a fitness function has to be defined. The assessment is done by the fitness function which returns a fitness value reflecting how optimum the solution is: greater the number, excellent the solution. In ABS design optimization problem, the throughput of UEs positioned in the femtocells, in addition, all other users are also enhanced. The target of this algorithm is to fix the finest ABS sequence that raises the total throughput of all users. The reason of enhancement is to make sure that the traditional algorithm is to obtain a substantially high value of throughput in the proposed system.

3.4.1 Fitness for the Population

The equal sharing of loads is reliant on the fitness function which relies on JFI. It is said that the loads are equally shared, as the JFI value is 1. The chief target is to stabilize the cell resource loads in the heterogeneous networks. A typical scenario of heavily loaded macro cells and casually loaded small cells yields a low fairness index at the commencement of the optimization. As the small cells' range is extended, added traffic is offloaded as of the macrocells, furthermore the FI is augmented. For a network of N cells, JFI for cells' loads is of the form given equation (1),

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$$Jain's\,Fairness\,Index = \frac{\sum_{i=1}^{N} L_i^2}{N \cdot \sum_{i=1}^{N} L_i^2} \tag{1}$$

where, L specifies Loads. Here, cell loads are not capped at 1 for optimum efficiency. Despite of the actuality that 100% is the maximum cell resource utilization, high degrees of cell overload is better measured in the optimization by not capping cell loads to 1. Jain's fairness index for cell loads provides insight on the level of LB in the network. The fairness index (FI) has a range between 1 and 1/N. The maximal value of 1 is attained when every cell has the same load. On the contrary, networks of a large degree of imbalanced load yield a low JFI.

3.4.2 Load Estimation

During optimization, the cell loads are estimated using load coupling equation given in equation (2).

$$L_i = \sum_{j \in (users\,in\,cell\,i)} \frac{d\_rate_j}{Max\_DR_{ij}} \tag{2}$$

Where, d_rate_j is the demanded data rate by a user j. Max_DR_{ij} is the maximal attainable data rate for a user j, assuming maximum utilization of time and frequency resources of a cell i.

Max_DR_{ij} of users j assisted by a cell i for RE users are evaluated using the equation (3).

$$Max\_DR_{ij} = ABS_i^{R\_Power}\% \cdot \alpha_{Downlink} \cdot R \cdot B \cdot \log_2\left(1 + SINR_{ij}\right) \tag{3}$$

Max_DR_{ij} of user j served by a cell i for Non-Range Expansion (NRE) users is evaluated utilizing the equation (4).

$$Max\_DR_{ij} = (1 - ABS_i^{R\_Power}\%) \cdot \alpha_{Downlink} \cdot R \cdot B \cdot \log_2\left(1 + SINR_{ij}\right) \tag{4}$$

Max_DR_{ij} of user j -assisted by a cell i for macrocell users is estimated utilizing the equation (5).

$$\begin{aligned} Max\_DR_{ij} = (1 - ABS_i^{R\_Power}\%) \cdot \alpha_{Downlink} \cdot R \cdot B \cdot \log_2\left(1 + SINR_{ij}\right) + \\ ABS_i^{R\_Power}\% \cdot \alpha_{Downlink} \cdot R \cdot B \cdot \log_2\left(1 + SINR_{ij}\right) \end{aligned} \tag{5}$$

Where, $ABS_i^{R\_Power}\%$ is the section of the radio time frame that is almost blanked with reduced power, $\alpha_{Downlink}$ is the alpha downlink correction factor, which is utilized to evaluate the downlink level capacity of the channel, R is the number of RBs of the carrier, B is the Bandwidth (in Hertz) per resource blocks reserved for data transmission and $SINR_{ij}$ is the SINR aimed at a user j -assisted by cell i.

For a network utilizing Reduced Power – ABS, $SINR_{ij}$ of user j -assisted by a small cell i is formed as given inequation (6) for RE users.

$$SINR_{ij} = \frac{T_p l_{ij}}{\sum_{s \in SC/\{i\}} T_s l_{sj} + \sum_{m \in MC} T_m l_{mj} (PC)_{i,m}^{ABS} + \sum_{m \in MC} \frac{T_m}{TR_m} l_{mj} \left(1 - PC_{i,m}^{ABS}\right) + tn} \tag{6}$$

$SINR_{ij}$ of user j served by a small cell i is formulated as given in equation (7) for Non-Range Expansion (NRE) users.

$$SINR_{ij} = \frac{T_p l_{ij}}{\sum_{s\in SC/\{i\}} T_s l_{sj} + \sum_{m\in MC} T_m l_{mj} (PC)_{i,m}^{NonABS} + \sum_{m\in MC} \frac{T_m}{TR_m} l_{mj}\left(1 - PC_{i,m}^{NonABS}\right) + tn} \tag{7}$$

For macrocells, the SINR depends on whether the user is scheduled on a regular subframe or reduced power subframe. For a user j served in a regular subframe by macrocell i, $SINR_{ij}$ is calculated as given in equation (8).

$$SINR_{ij} = \frac{T_p l_{ij}}{\sum_{s\in SC} T_s l_{sj} + \sum_{m\in MC/\{i\}} T_m l_{mj} (PC)_{i,m}^{NonABS} + \sum_{m\in MC/\{i\}} \frac{T_m}{TR_m} l_{mj}\left(1 - PC_{i,m}^{NonABS}\right) + tn} \tag{8}$$

For a user j served in RP-ABS by macrocell i, $SINR_{ij}$ is calculated as given in equation (9).

$$SINR_{ij} = \frac{T_p l_{ij}}{\sum_{s\in SC} T_s l_{sj} + \sum_{m\in MC/\{i\}} T_m l_{mj} (PC)_{i,m}^{ABS} + \sum_{m\in MC/\{i\}} \frac{T_m}{TR_m} l_{mj}\left(1 - PC_{i,m}^{ABS}\right) + tn} \tag{9}$$

Where, T_p is the transmit power of cell i, l_{ij} is the path loss betwixt cell i and user j masked by the antenna gain for a cell i. tn is considered as the thermal noise over the system bandwidth. SC is the set of small cells in the network and MC is the set of macrocells in the network. $PC_{i,m}^{ABS}$ is the probability of collision betwixt cells i and m in a regular subframe. A collision in this context means interference from one cell to other cells in the indicated type of subframe. As the small cells not blank any section of their subframes, interference from small cells is concerned with probability 1. TR_m is based on the power reduction.

Within an LTE radio frame, if the starting instances of all blank subframes are synchronized and aligned, $PC_{i,m}^{ABS}$ and $PC_{i,m}^{NonABS}$ are calculated using the equations (10) and (11) respectively.

$$PC_{i,m}^{ABS} = \frac{\max\left(0, ABS_i\% - ABS_m\%\right)}{ABS_i\%} \tag{10}$$

$$PC_{i,m}^{ABS} = \frac{1 - ABS_i\% - \max\left(0, ABS_m\% - ABS_i\%\right)}{1 - ABS_i\%} \tag{11}$$

The finest fitness by optimizing ABS and Cell Range for all the population is determined and is sorted. Now, the best half of the fitness is chosen from the sorted list and undergoes mutation together with crossover. Then, the solutions are updated which gives the last end solution.

IV. RESULTS AND DISCUSSION

This section displays the performance estimation of the proposed Optimized Load Sharing using Enhanced Genetic Algorithm with the other existing techniques. The performance metrical like, FI along with throughput based on considering interference and devoid of considering interference are utilized for assessing the technique which is proposed. The proposed technique is done in the MATLAB platform.

The fundamental intention is to equally share the loads among the macrocells in addition to the femtocells by optimizing ABS and also cell range using the proposed EGA. The experiments are performed in a basic network with 4 macrocells each located in the hexagonal sectors. Each macrocell comprises of 2femtocells. The performance of optimized load sharing using EGA is assessed in two situations. One is through considering interference and also the other is without considering interference amongst the macrocellsas well as the femtocells on a network.

4.1 Fairness Index

Generally, fairness is attributed to resource distribution or else allocation. The result of an unjust resource allocation amongst various individuals may prompt resource starvation, resource expenditure or redundant allocation. In the proposed work, JFI is utilized as a performance metric to indicate the perfect load sharing. The equal sharing of loads is grounded upon the fitness function which relies on JFI. It can be said that the loads are equally shared when the value of JFI is 1.

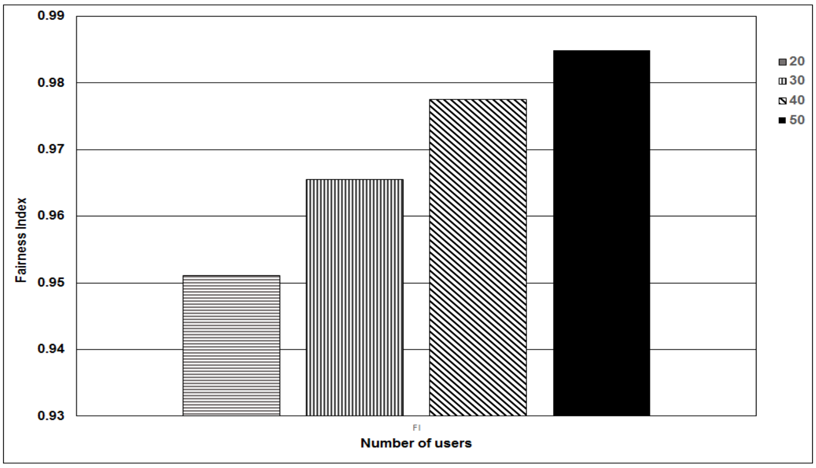

Figure 4.1 Performance Analysis of Fairness Index of the proposed technique in terms of Number of Users

Fig 4.1 analyses the proposed work's FI concerning a number of users on the network. In the graph, x-axis signifies the number of users and also y-axis implies the values of FI. For 20 users, FI is 0.951079, which is the lowest for the compared total users. But, as the users are increased, it can well be inferred that the FI also increases. For 50 users, FI is 0.984968, which is superior to the values for 30 and 40 users. So, it can well be said that the perfect load sharing can be maintained even when the number of users is increased.

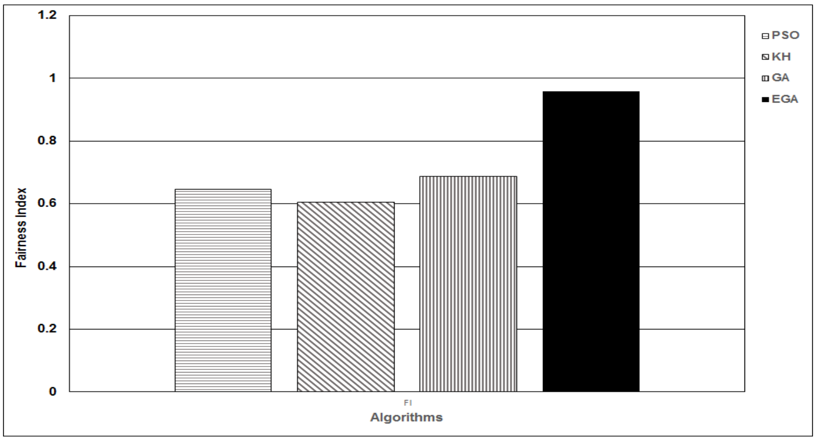

Figure 4.2 Performance Analysis of Fairness Index of the proposed technique by considering interference

Figure 4.2 analyses the proposed technique’s FI by considering interference in the macro-femto centered network. The consideration of interference entails that the expanded area of the femtocell spreads out to the close bymacrocell. In the figure, x-axis signifies the algorithms that were compared; in addition, y-axis implies the FI values. Here, prevailing algorithms are Particle Swarm Optimization (PSO), GA and KH (Krill Herd) and the proposed EGA are compared. Among all the compared algorithms, KH has the lowest FI which is 0.605307 and the FI of PSO and GA varies by 0.032911. The proposed EGA has 0.955764, which is the highest FI and as an outcome, it indicates perfect sharing.

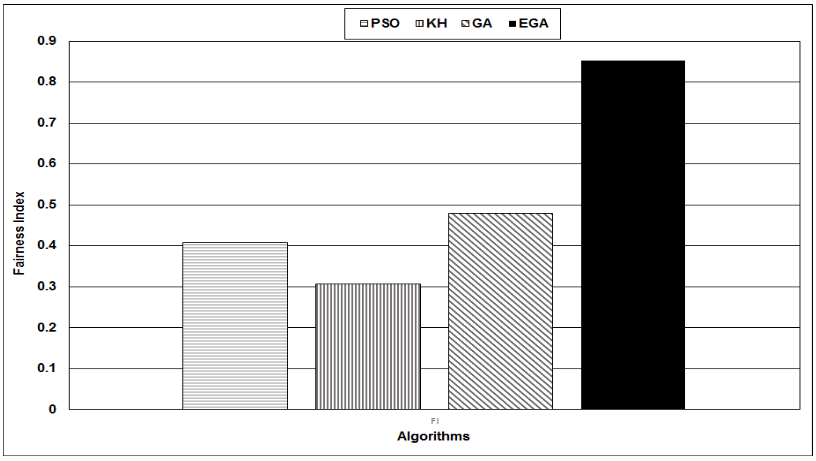

Figure 4.3 Performance Analysis of Fairness Index of the proposed technique without considering interference

Fig 4.3 analyses the proposed technique's FI without considering interference in the macro-femto centered network. The inconsideration of interference implies that the expanded region of the femtocell spreads within its own macrocell. In the graph, x-axis infers the algorithms that were compared and also y-axis alludes to the values of FI. The proposed EGA is compared with the existing PSO, KH, and GA. Here, KH shows very poor performance which has the FI 0.30796 and that of PSO and GA have 0.407962 and 0.479071 respectively. The proposed EGA shows the greater performance and has greater FI which is 0.852821 and has the perfect sharing of loads.

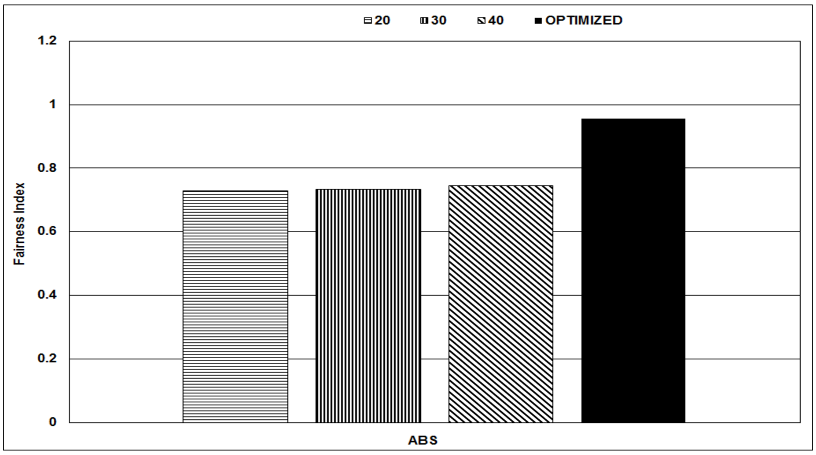

Figure 4.4 Performance Analysis of Fairness Index of the proposed technique with Fixed ABS

Figure 4.4 analyses the proposed technique's FI with fixed ABS in the macro-femto network. Here, x-axis signifies the ABS and also y-axis signifies the FI. For fixed ABS values of 20, 30 and 40, the FI is approximately similar with a very few differences. When ABS is fixed to 20, 30 and 40, the values of the fairness indexes are 0.728309, 0.734286 and 0.744168 respectively. But, for the proposed optimized ABS values, the FI is 0.955764, which is the highest among the compared values and as the value is near to 1, the loads sharing can be said as perfect.

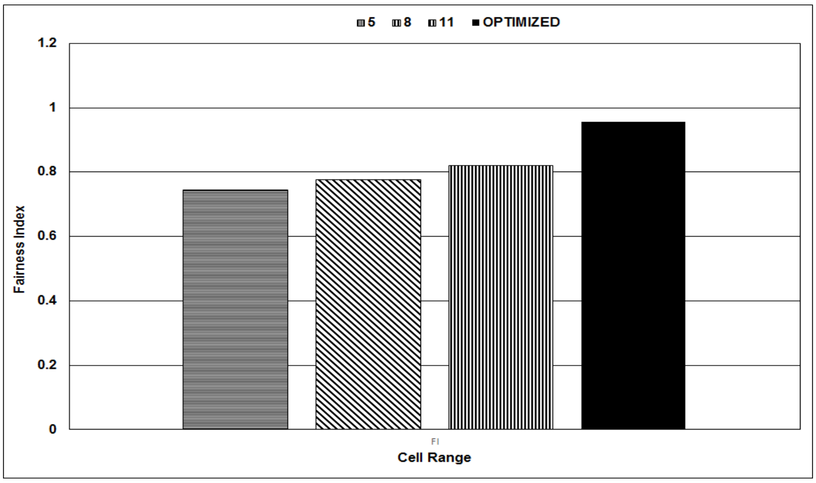

Figure 4.5 Performance Analysis of Fairness Index of the proposed technique with Fixed Cell Range

Fig 4.5 analyses the proposed technique's FI with fixed CR in the macro-femto centered network. Here, x-axis signifies the cell range and axis y implies the FI. For fixed CR values of 5, 8 and 11, the FI is approximately similar with small differences. When CR is fixed to 5, 8 and 11, the values of the fairness indices are 0.744168, 0.776372 and 0.819993 respectively. But, for the proposed optimized CR values, the FI is 0.95574, which is the highest among the compared values and as the value is near to 1, the loads sharing can be said as perfect.

Figure 4.6 analyses the proposed technique's FI with and without considering interference in the macro-femto centered network. Here, x-axis implies the technique EGA which is proposed and also y-axis signifies the FI. The consideration of interference entails that the expanded area of the femtocell spreads out to the close by macrocell. The inconsideration of interference entails that the expanded region of the femtocell spreads within its own macrocell. The FI value by considering interference is 0.852821 and the value for in consideration of interference is 0.955764. It can be deduced that the sharing of loads is perfect in the case when the femtocell is expanded to the close by the macrocell.

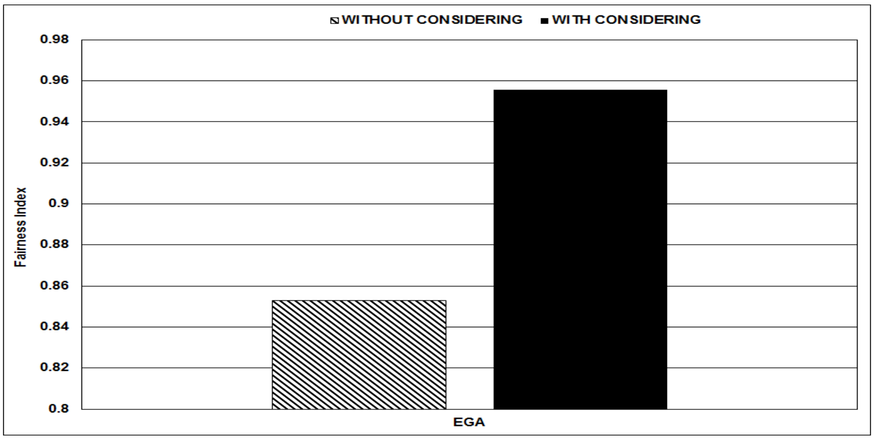

Figure 4.6 Performance Analysis of Fairness Index of the proposed technique with and without considering interference

V. CONCLUSION

Range Expansion technique aspires to balance loads of the macrocell and the femtocell by enlarging the section of femtocell area and augmenting the total users who are fixed for the femtocell. In such range expanded environment, a problem arises in sharing the nodes equally among the macrocells and the low-power nodes, for instance, femtocells. The given paper proposes a technique for sharing loads of macrocells with the femtocells by means of range expansion. The proposed technique optimizes the ABS and cell range with the assist of EGA for effectively sharing the loads between the macrocell and the femtocell. The proposed technique's performance is analyzed with the aid of metrics, Fairness Index. The proposed EGA is compared with the existing PSO, KH, and GA. Also, the performance of optimized load sharing using EGA is evaluated in two situations. One is through considering interference and also the other is without considering interference amongst the macrocellstogether with the femtocells in a network. Experimental outcomes display that the technique which is proposed offers promising results in equal sharing of loads and outperforms other conventional techniques.

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