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1.0 Introduction

- The challenge in wireless mobile network is the assignment of appropriate frequency spectrum channels to requested calls while satisfying electromagnetic compatibility (EMC) constraint.

- Limited capacity of wireless mobile frequency spectrum.

- Adaptive GA-based hybrid channel assignment (HCA) technique is capable to maximize the utility of the limited resources.

2.0 Objective

- To implement a GA-based HCA algorithm to solve the limited frequency band problem.

- Capable to reduce the call blocking or call dropping probability compared to HCA scheme of deterministic method.

3.0 Methodology (Genetic Representation)

- Generation of initial population
  - When a new call arrives in cell *k*, initial population based on eligible channels, *I(k)=S-(O(k)* U *U(k))* is generated.

- Fitness Function
  - Three soft constraints such as packing condition, resonance condition and limitation of reassignment are modeled as fitness function.

$$F = \sum_{j=1}^{t_k} \sum_{i=1 i \neq k}^{C} A_{i,V_{k,j}} . reuse(i,k) - \sum_{j=1}^{t_k} \sum_{i=1 i \neq k}^{C} A_{i,V_{k,j}} . \frac{1}{dis(i,k)} - \sum_{j=1}^{t_k} A_{k,V_{k,j}}$$

Resonance Packing Limiting reassignment

3.0 Methodology (Genetic Representation)

- Mutation
  - Mutation rate - to indicate the probability for a gene in the chromosome to mutate.
  - When the channel number is decided for mutation, the value will be swapped with the corresponding vector of eligible channels.

- Crossover
  - Crossover rate – indicate the probability for parents' vectors to produce a better child chromosome (from each of the parents).
  - One-point crossover to reduce computational cost.

4.0 Simulations

- Simulation on a 49-cells network model for both uniform and nonuniform traffic demands.

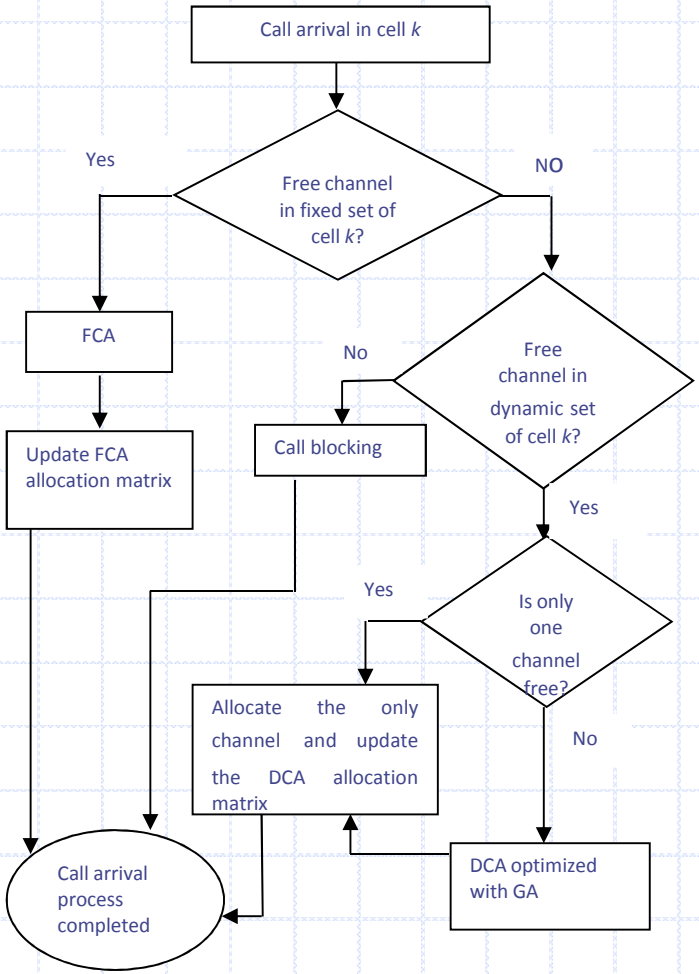
- Simulation is performed based on a reuse distance of three units.

- The representative ratios applied in the HCA scheme are 21:49 (21 channels in fixed set and 49 channels in the dynamic set), 35:35, and 49:21.

- The performance of the algorithm is evaluated in terms of call blocking probability, *P*.

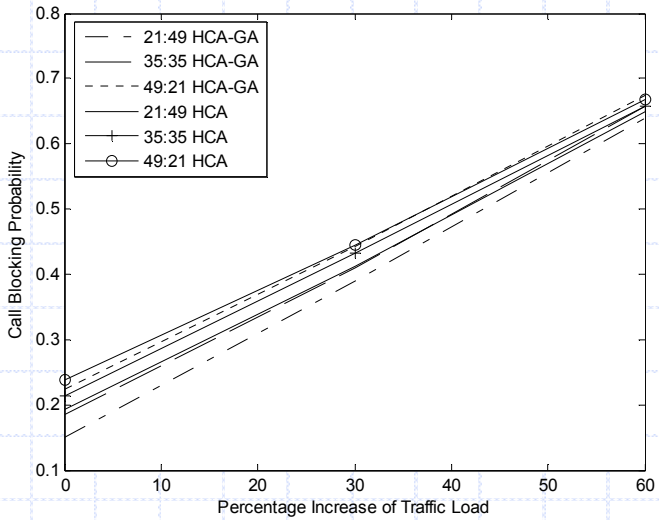
P=total new call blocked/total call arrived in system

4.0 Simulations



Simulation of call arrival event in HCA scheme optimized with GA strategy

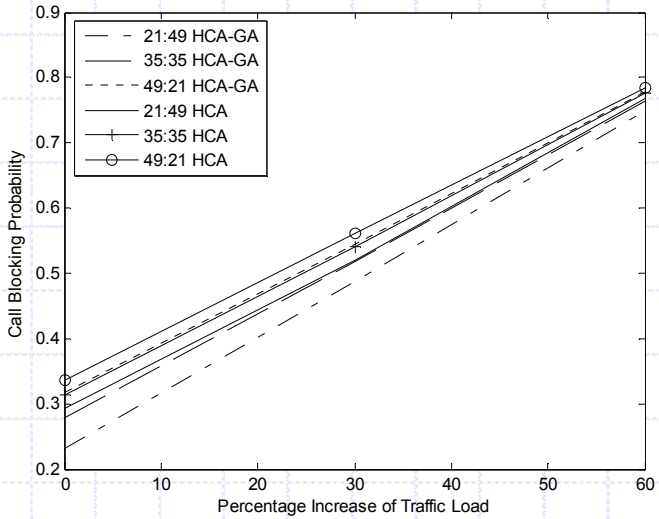
5.0 Results and Discussion



Call blocking probability performance of HCA-GA for the cellular network with uniform traffic distribution

- 21:49 HCA-GA scheme produces the lowest call blocking probability compared to the other representative ratios and HCA scheme of deterministic method under uniform call traffic distribution.

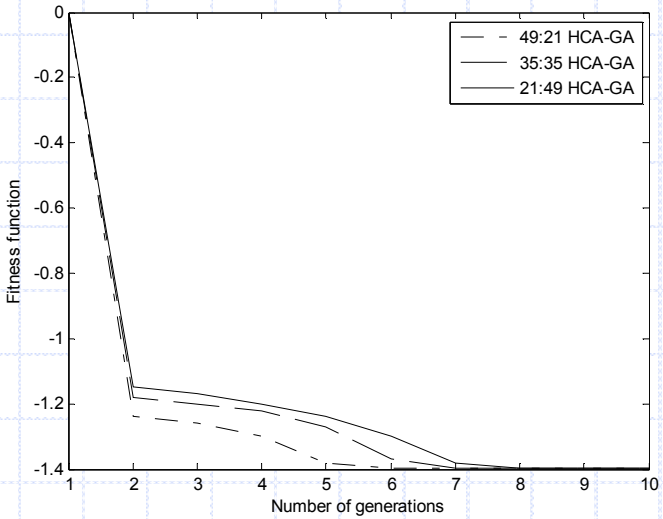
5.0 Results and Discussion



Call blocking probability performance of HCA-GA for the cellular network with nonuniform traffic distribution

- 21:49 HCA-GA scheme produces the lowest call blocking probability compared to the other representative ratios and HCA scheme of deterministic method under nonuniform call traffic distribution.

5.0 Results and Discussion



Characteristics of GA-based HCA scheme for the representative ratios of 49:21, 35:35 and 21:49

- The smallest average number of generations required to converge refer to 49:21, which is approximately 5 generations.

6.0 Conclusion

- For all the representative ratios, GA-based HCA scheme always shows better performance in terms of call blocking probability, under both uniform and nonuniform traffic distribution conditions.

- Among all the representative ratios, the best performance in terms of call blocking is obtained by the 21:49 HCA-GA scheme.

- In terms of the performance of computation time, 49-21 HCA-GA scheme is faster.

- Therefore the 35:35 HCA-GA scheme can be used to maintain a balance between the extremes of call blocking probability and computational effort.

- In future, the proposed algorithm can be investigated for different network model and different reuse distance.