

# Use of Particle Swarm optimization for Improvement in Wireless Communication Systems

Priyanka Narware      Keshav Mishra  
priyashish26@gmail.com      kjairam09@gmail.com  
Dept. of Electronics and communication  
SIRTS, Bhopal, India

**Abstract-** The any aspects of the wireless communication are address by the researchers. The many problems of wireless communication system required the use of optimization techniques. Different optimization techniques are used over the time. The particle swarm optimization technique is a proven successful technique for optimization. This technique is successfully used in different area of wireless communication system. In this paper, survey for use of this technique in wireless communication system is discussed. With the evolution of new generation of wireless communication system, the use of optimization technique becomes significant.

**Keywords-** Wireless communication system, Evolutionary technique, PSO, Evolutionary Algorithms (EA), etc.

## I. INTRODUCTION

Wireless communication system is a very difficult and important system that affects your needs. Today world is being compact on account of advancement of science and its technologies. During last two decades, the world has seen rapid evolution of mobile communication technologies from GSM to LTE-A systems. These evolutions were based on need for more bandwidth, lower latency, radio access and switching schemes. Collectively related performance enhancement and parameters like inter channel, interference, compatibility with networks, energy efficiency, connectivity and jitter are need to kept in mind when developing new wireless communication technology. In correspondence to, we are researching the most leading mobile technology, could be 5G.

5th Generation technology will replace the use of mobile phones within real high bandwidth. 5G is a packet switched wireless application with advanced area broadcasting and high throughput. 5th Generation communications use CDMA and BDMA and milli metre wireless which authorizes seed is higher than 100Mbps at full speed and greater than 1Gbps at low speed. It is not astonishing, such a large accumulation of technology being computed into a little device. It provides cellular phone customers additional features and effectiveness.

A customer of cellular phone can comfortably fix their 5G technology device with laptops or tablets to receive broadband internet connectivity. Today, all wireless and mobile networks are based on IP principle, that means all data and signalling will be communicated through Internet Protocol on network layer. The objective of IP Network (AIPN) is to entirely change the decades old legacy network framework into a streamlined and

standardized network with a common framework for all kind of services.

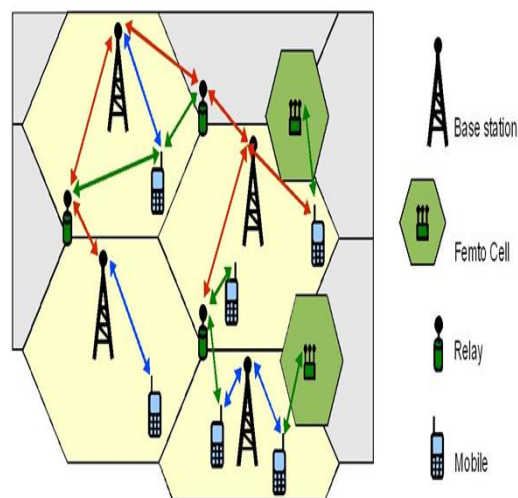


Fig. 1 Basic block wireless communication system

This system is becoming day-to-day demanding in term of the speed and accuracy. New evolution or generation in this system is coming continuous. Any improvement in this system is very special because it relates to lifestyle. Over the years different evolutionary algorithms have emerged based on biological behaviour. The PSO method is an evolutionary optimization algorithm that is based on swarm performance of bird flocking..

## II. PARTICLE SWARM OPTIMIZATION (PSO)

Particle swarm improvement (PSO) may be a swarm Intelligence technique for global optimization. Particle swarm improvement (PSO) may be a swarm intelligence method for globe optimization technique. It varies from other well-known Evolutionary Algorithms (EA). As in evolutionary algorithms, a population of potential solutions was used to probe the search space, and then no operators, inspired through evolution procedures, are applied on the population to generate new promising solutions scheme. Instead, in particle swarm improvement, named particle, every individual, of the population, called swarm, adjusts its trajectory toward its own previous greatest position, and toward the previous best position obtain through any member of its topological neighbourhood.

Thus, international distribution of knowledge takes place and as well the particles take advantage on the discoveries and kinder expertise of totally various companions throughout the victim around for promising regions of the landscape. With in the native variant of PSO, the neighborhood of every particle within the swarm optimization is restricted to an explicit variety of different particles however the movement rules for every particle are constant same in the two variant.

Many popular optimization algorithms are deterministic, like gradient-based algorithms. This allows the particle swarm optimization rule to be used on several functions wherever the gradient rule is either unprocurable or computationally obtained. The past many years, particle swarm optimization algorithm has been successfully applied in various researches. PSO is also attractive because there are fewer parameters to adjust. It is in contestible that particle swarm optimization gets higher ends up in a quicker, cheaper manner compared with several strategies.

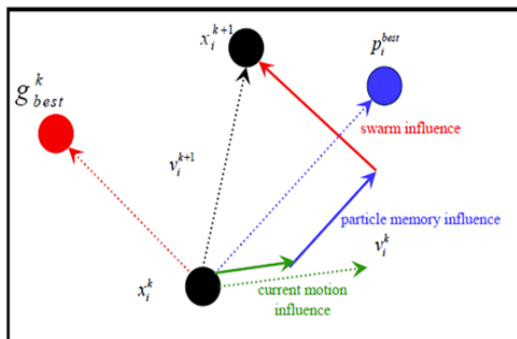


Fig. 2 describes the architecture of PSO.

## III. RELATED WORK

Researchers explored PSO in different domains of wireless communication systems.

**G. He, et.al**, in this paper, the proposed a new particle swarm optimization algorithm with an application. A new particle swarm optimization algorithm (NPSO) is presented for dealing with the portfolio model from stocks market, in which the optimal and sub-optimal positions of each particle are considered in the iteration process, and the crossover operation is used to avoid premature. Performance of NPSO compared with existed PSO. Later this proposed NPSO algorithm used to solve a discontinuous programming model [1].

**G. Karimi, et.al**, investigation this paper, Lotfi, An analog/digital pre-distorter using particle swarm optimization for RF power amplifiers. A novel pre-distorter presented using the PSO for an RF power amplifier linearization. PSO was used for in order to design of an efficient pre-distorter for the linearization of the output of an RF power amplifier. The PSO is implemented to estimate and optimize the coefficient parameters of the work function in pre-distorter block diagram. The proposed method using PSO found efficient because of independent nature of the output of the power amplifier. The proposed method has been simulated with two-tone input signal and compared with output power spectrum [2].

**O. S. Moraes, et.al**, the proposed robust parallel algorithm of the particle swarm optimization method for large dimensional engineering problems. The application of the PSO algorithm to large engineering problems is strongly limited by computational cost. These limitations are large number of particles needed to optimize the many-variable function, the high computational cost of its evaluation and the lack of adequate criteria to early detect the approach of the global optimum. First two cost sources can be mitigated by a parallel implementation of the PSO algorithm and third one need the development of a robust convergence criterion. To addresses these issues a new convergence criterion in asynchronous parallel implementation of PSO proposed by authors. Proposed optimization is examined for different benchmark test functions. The proposed method was successfully applied to an actual estimation problem with 81 parameters [3].

**W. Fang, J. Sun, et.al**, A decentralized quantum-inspired particle swarm optimization algorithm with cellular structured population. They proposed a decentralized form of quantum-inspired particle swarm optimization with cellular structured population (called cQPSO) for keeping the population diversity and balancing the global and local search. Particles are distributed in a two dimensional grid in cQPSO and only allowed to interact

with their neighbors according to the specified neighborhood. Theoretical studies based on the theory of probabilistic metric space are made to analyze the global convergence of cPSO. Performance of cQPSO investigated on 42 benchmark functions with different properties and compare with different sets of PSO variants and other evolutionary algorithms [4].

**B.Lakshmi Vani**, in this paper proposed Particle Swarm Optimization Based Power Allocation in Multi-Hop Cooperative AF Relaying Networks. We consider multi-hop AF cooperative relaying to increase the system performance. Power allocation is a major issue in a cooperative wireless system. Particle Swarm Optimization power allocation scheme is exploited for communication by considering perfect Channel State Information. By using Extreme Value Theory, the limiting distribution functions of the lower and upper bounds on the end to end signal to noise ratio can be derived. With PSO algorithm, we can minimize the outage probability as a constraint compared to water filling power allocation algorithm. The simulation results showed that the proposed PSO algorithm performs better compared to existing water-filling algorithm. By this, the coverage area of secondary users can be extended [5].

**H. Lu**, in this paper, particle swarm optimization assisted joint transmit/receive antenna combining for multiple relays in cooperative MIMO systems. A novel relay resource utilization scheme was presented that uses the PSO algorithm to jointly search the antenna combining (AC) matrices of multiple relays in cooperative MIMO systems. The relays utilize AC matrices to weight and combine signals transmitted by the source node, and then forward the weighted signal to the destination node. Relays can reduce the number of radio frequency (RF) chains used for transmit/receive antenna elements and resultant lower the hardware costs of deploying RF chains. So, reduction in RF chains requires less power than relays that use all the RF chains. Computer simulation has been used to demonstrate the performance of proposed scheme with other existing approaches in some scenarios [6].

#### IV.CONCLUSION

Performance is most prime demand in of communication technique and in day to day increasing insolubility of communication system made it as challenging task to design accurate device for it. The various optimization methods are used for this purpose other than particle swarm optimization method is shown it suitable for this purpose because to simplicity and fast convergence rate.

#### REFERENCES

- [1] B.LakshmiVani, Dr.K.Rama Naidu, "Particle Swarm Optimization Based Power Allocation in Multi-Hop Cooperative AF Relaying Networks", International Journal of Innovative Research in Computer and Communication Engineering, Vol. 6, Issue 3, March 2018.
- [2] W. Fang, J. Sun, H. Chen, and X. Wu, "A decentralized quantum inspired particle swarm optimization algorithm with cellular structured population," Inf. Sci. (Ny), 2016.
- [3] O. S. Moraes, J. F. Mitre, P. L. C. Lage, and A. R. Secchi, "A robust parallel algorithm of the particle swarm optimization method for large dimensional engineering problems," Appl. Math. 14, 2015.
- [4] G. He and N. Huang, "A new particle swarm optimization algorithm with an application", Appl. Math. Comput., vol. 232, Apr. 2014.
- [5] G. Karimi and A. Lotfi, "An analog / digital pre-distorter using particle swarm optimization for RF power amplifiers," Int. J. Electron. Commun., vol. 67, 2013.
- [6] H. Lu, "Particle swarm optimization assisted joint transmit/receive antenna combining for multiple relays in cooperative MIMO systems", Appl. Soft Comput. J., vol. 12, no. 7, pp. 1865–1874, 2012.
- [7] Kwangyul Kim, Yoan Shin, "An Improved Power Allocation Scheme Using Particle Swarm Optimization in Cooperative Wireless Communication Systems", IEEE, 2nd – 5th October 2011.
- [8] MithunChakraborty, RiniChowdhury, JoydeepBasu, R. Janarthanan, AmitKonar, "A Particle Swarm Optimization-based Approach towards the Solution of the Dynamic Channel Assignment Problem in Mobile Cellular Networks".
- [9] Chatterjee A., Siarry P. "Nonlinear inertia weight variation for dynamic adaptation in particle swarm optimization", Computers and Operations Research, 2016.
- [10] Chen M.Y., Zhang C.Y., Luo C.Y. "Adaptive evolutionary multi-objective particle swarm optimization algorithm", Control and Decision, 24(12), 2015.
- [11] Yoke Chek Yee, Su Wei Tan, HengSiong Lim, and Su Fong Chien, "Application of Particle Swarm Optimizer on Load Distribution for Hybrid Network Selection Scheme in Heterogeneous Wireless Networks", 23 March 2012; Accepted 19 June 2012.
- [12] S. Yogi, P. K. R. Subhashini, P. J. K. Satapathy, and S. Kumar, "Equalization of Digital Communication Channels Based on PSO algorithm", IEEE International Conference on Communication Control and Computing Technologies (ICCCCT), 2010.