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NSDE Based Power Allocation and Relay Selection in Secure Cooperative Networks

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Abstract :

In wireless networks, the transmission between legitimate users can be easily overheard by an eavesdropper for interception due to the broadcast nature of wireless medium, making the wireless transmission highly vulnerable to eavesdropping attacks. In order to achieve the confidential transmission, existing communications systems typically adopt the cryptographic techniques to prevent an eavesdropper from tapping the data transmission between legitimate users. Today wireless communication networks are widely used due to different applications is required that the data transmitted should be secure. So at the physical layer, we have to give more security for avoiding eavesdropper from decoding any message exchanged by legitimate user. In this paper, we propose NSDE based multi-objective algorithm for efficient relay selection and power allocation. The proposed scheme enables an opportunistic selection of two relay nodes to increase security against eavesdropping and jams the reception of the eavesdropper. Simulation results show that the proposed relay selection schemes have the ability to search global optimal solution and have less computational complexity compared with exhaustive search.

INTRODUCTION
A BACKGROUND

Recently utilizing the cooperative transmission to improve the physical layer security of a wireless communication system. The basic idea of physical layer security is to exploit the physical characteristics of wireless channels to provide secure communications. Among the cooperative techniques optimal relay selection (ORS) is a useful strategy for practical implementation. This is because (ORS) is a low complexity strategy consisting only in activating the best relay. For a system all terminals only equipped with single antenna. In case of multiple nodes two efficient ways are taken. They are cooperative beam forming and jamming. Cooperative beam forming helps to improve the channel quality to the destination, while cooperative jamming degrades the channel condition of the eavesdroppers. Both will improve the security of the data transmission. A wireless ad hoc network is an autonomous and self organizing network without any centralized controller infrastructure. In this network randomly distributed nodes forms a temporary functional network and support seamless leaving of nodes. Wireless sensor networks can use the cooperative relaying to reduce the energy consumption in sensor nodes, hence lifetime of sensor network increases. The simplest cooperative relaying network consist of three nodes, namely source, destination, and a third node supporting the direct communication between source and destination denoted as relay .If the direct transmission of a message from source to destination is not successful ,the overheard information from the source is forwarded by the relay to reach the destination via a different path. Since the two communications took a different path and take place one after another. The relaying strategies can be further divided by amplify and forward, decode and forward and compress and forward.

The amplify and forward strategy allows the relay station to amplify the received signal from the source node and to forward to it to the destination .Relays following the decode and forward strategy overhear transmissions from the source, decode them and in case of correct decoding, forward them to the destination . Cooperation leads to interesting trade off in transmit power and code rates. In case of power one may argue on one hand more power is needed. On other hand, the baseline transmitted power for both users will be reduced because of diversity. In cooperative communication each user transmits both his/ her own bits as well as some information for his /her partner. One might think this causes loss of rate in the system. However the spectral efficiency of each user improves. Due to cooperation diversity the channel code rates can be increased. A trade off is observed.

B CONTRIBUTION:

This paper deals with NSDE based multi-objective

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algorithm for efficient relay selection and power allocation. The proposed scheme enables an opportunistic selection of two relay nodes to increase security against eavesdroppers. The first relay operates as a conventional mode and assists a source to deliver its data to a destination. The second relay is used in order to create intentional interference at the eavesdropper nodes. The proposed selection technique jointly protects the primary destination against interference and eavesdropping and jams the reception of the eavesdropper.

C Paper Organization:

The paper is organized as follows section II deals with the related work in Multi- Objective Optimization. Section III deals with non sorting Dominated Differential Evolution, Section IV deals with Methodology and Section V indicates result and Performance analysis and section VI indicates Conclusion

II RELATED WORK:

Differential Evolution plays an important role in optimization. Er.Anuj Kumar Parashar presents multi-objective optimization using differential evolution. Several issues arise in multi objective optimization. Firstly entire space has to be searched without getting stuck in local optima. Secondly it should approach the global Pareto optimal-front as possible. Thirdly the search should ensure a good spread of solution along the obtained Pareto optimal front. Finally it should achieve convergence in reasonable time. For this purpose of implementing differential evolution a new Multi-objective Optimization algorithm was designed. In this scheme overall performance is low. B.V.Babu presents extension of differential evolution for multi-objective optimization. It is significantly faster and robust for optimization problem over continuous domain. This algorithm is applied to two different benchmark problems. Time consumption will be more.

III.Non-dominated Sorting Differential Evolution (NSDE):

NSDE algorithm is a simple extension of DE for solving multi-objective optimization problems. The working of NSDE and DE is similar except the selection operation that is modified in order to solve the multi-objective optimization problems.

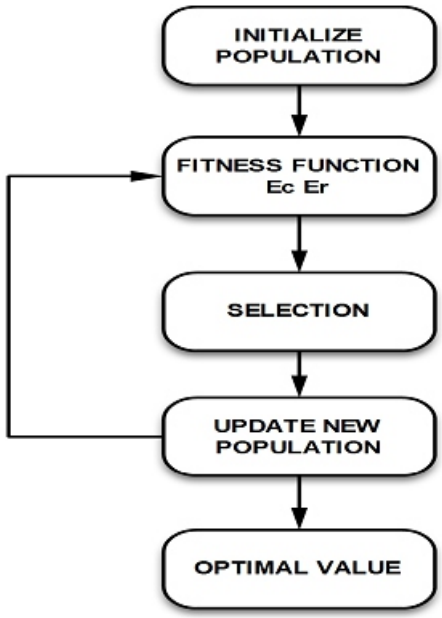

Fig : Operation of NSDE

First of all set the key, i.e., CR- crossover constant, F-scaling factor, NP- population size, maximum number of generations of NSDE algorithm. And then randomly initialize the population points within the bounds of decision variables. After initialization of population, randomly choose three mutually different vectors for mutation and crossover operation to generate trial vector. Evaluate the trial and target vector and perform a dominance check. If trial vector dominates the target vector, the trial vector is copied into the population for next generation otherwise target vector is copied into population for next generation. This process of mutation crossover and dominance check is repeated for specified number of generations. Evaluate and then sort this final population to obtain the non-dominated solutions.

IV METHODOLOGY:

The network system model consists of a source node, co-operative nodes, destination node and eavesdropper. All nodes in the network are equipped with single antenna and operate in a half duplex DF mode. Then selection of two relay nodes is assumed. First relay node send original message to destination, second relay node cause interference against eavesdroppers. Then the general NSDE involves optimizing multi objective optimization problem. Then the power allocation will be done in each node. Here the power will be optimized.

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The optimal value can be measured by NSDE. Initialize the population points. Then choose trial vector and target vector. Trial vector dominates the target vector. Trial vector is copied into the next generation otherwise target vector is copied into the next generation. Dominance check and mutation cross over is repeated. Then sort final population.

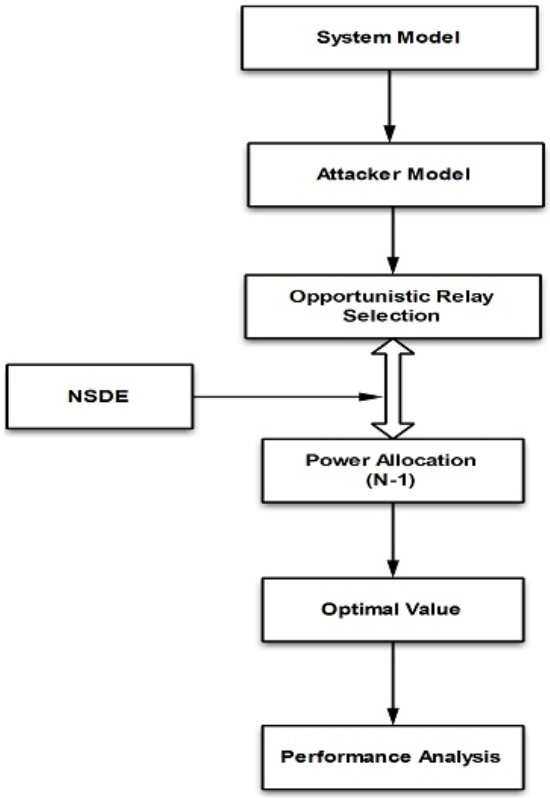

Fig : Block Diagram

Relaying:

Relays that receive and retransmit the signals between base stations and mobiles can be used to increase throughput extend coverage of cellular networks. Infrastructure relays do not need wired connection to network thereby offering savings in operators backhaul costs. Mobile relays can be used to build local area networks between mobile users under the umbrella of the wide area cellular networks. From signal processing point of view AF relays offer interesting challenges, especially when the AF relay operates in full-duplex mode: Adaptive algorithms are required for loop back interference cancellation. Furthermore, the effect of interference must be incorporated into analytical performance studies. Spectral shaping of the transmitted signal requires advanced techniques for digital filter design.

The research benchmarks AF relays with DF relays taking into account the aforementioned issues. We cooperate with High-frequency and microwave engineering group to gain understanding of the actual propagation environment and loop-back interference with full-duplex relays. When introducing relaying to a cellular system it is necessary to specify which functionalities and protocols should be included in the RN, and whether RNs should operate at the physical, link, or network layer. An AF relay inherently operates on the physical layer, while functionalities in a DF relay fall into data link or higher layers. Thereby, the variety of functionalities to design DF relaying protocols is wide. In case of OFDMA, sub channel assignment presented below is one possible functionality in relay that can be used to improve system performance. The capacity of the setup below, where the destination is able to hear both source and relay remains unsolved in general case. Several upper and lower bounds have been presented for the general case, and capacity has been solved in some special cases, e.g. on degraded relay channel. In recent years cooperative relay techniques have received a lot of interest. A typical link-level setup is depicted below, in which a group of relays help the communication between source and destination.

The relays can then use a space-time code or the most reliable relay can be chosen to transmit the signal while the other relays suspend transmission. Practical issues of cooperative schemes like signaling between relays and different propagation delays due to different locations of relays are often overlooked. If the difference in time of arrival between the direct path from source to destination and the paths source-relay-destination is constrained then relays must locate inside the ellipsoid as depicted below. Thus, in practice, such a cooperative system should be a narrow band one, or guard interval between transmitted symbols should be used to avoid inter-symbol interference due to relays. Mobile relays can be used to build local area networks between mobile users under the umbrella of the wide area cellular networks.

From signal processing point of view AF relays offer interesting challenges, especially when the AF relay operates in full-duplex mode: Adaptive algorithms are required for loop-back interference cancellation. Furthermore, the effect of interference must be incorporated into analytical performance studies. Spectral shaping of the transmitted signal requires advanced techniques for digital filter design.

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V RESULT AND PERFORMANCE ANALYSIS:

For better performance the NSDE technique like power allocation and relay selection is done. The simulation environment consists of single source, destination, relay and eavesdroppers. The relay selection will be based on multi objective optimizationWhich helps to increase the data rate and power optimization is done .finally performance Analysis will be done

VI Conclusion:

In this project cooperative secure transmission for a DF network is studied with only the CDI of the potential eavesdroppers. An opportunistic relay node is adopted for forwarding the confidential information and the other relay nodes send the artificial jamming for confusing the eavesdroppers. Then proposed NSDE based multi-objective algorithm for efficient relay selection and power allocation. The proposed selection technique jointly protects the primary destination against interference and eavesdropping and jams the reception of the eavesdropper. Simulation results show that the limiting distribution analysis is a very efficient technique, which coincides the numerical calculations very well even when the number of nodes is not so large.

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