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# AN IMPROVED ADAPTIVE BEAM FORMING ALGORITHM FOR 5G INTERFERENCE-CO EXISTENCE COMMUNICATION

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***Abstract***

*Multiple wireless systems coexisting in a 5G network might produce interference in the same frequency band, degrading the received signal's performance. In this project, novel algorithm is proposed in antenna array processing to handle interference-coexistence communication. We adopt a linear filter which is called Linearly Constrained Minimum Variance (LCMV) filter. We impose a log-sum penalty on the coefficients and add it to the cost function based on classic singly linearly constrained least mean square (LC-LMS). The iterative formula for filter weights is derived.We demonstrate that the new method's convergence rate is faster than the traditional one using simulations in an antenna environment with a signal of interest, noise, and interferences. Furthermore, the proposed method's mean-square-error (MSE) is confirmed. Our technique has a lower MSE than the classicLC-LMS algorithm, according to the findings of the experiments. The suggested adaptive beam forming approach can be used in a 5Gsystem to deal with signal and interference co existence.*

## 1. INTRODUCTION

Extensive deployment of fifth generation (5G) communication started to take place in few countries around the world. There fore, extensive studies on channel modeling and signal measurements with respect to the physics fundamentals are needed to properly design the architecture whereby such signals are precisely transmitted and received. The motivation of using such technology is that it promises higher data rates and enhanced network performance relative to the existing ones.This is typically achieved by exploiting wider ranges of bandwidth in higher frequency bands, for example 30 Gigahertz (GHz). For instance, millimeter wave communication provides upto10Tera bits data rates and spectral efficiency(SE)of approximately 100 bps/Hz over a bandwidth of about 270 Megabits per second (Mbps) (30–300GHzfrequency band).The Federal

 

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Communication Commission (FCC) initiative of band width allocationin5G.Clearly, the existing long-term evolution (LTE) system will no longer be able to embrace the network demands such as data rates and spectrum needed neither solve for the challenges such as the excessive interference. Given that, investigations on the performance of the system with respect to the operating frequency and bandwidth such as the Terahertz (THz) bandwidths are already ongoing because of the high capacity figures it provide. On the other hand, higher frequencies are extremely fragile especially in wider distances which en forces the fact that higher frequencies are best for indoor communications. This has encouraged researchers to investigate the possibility of designing transmitters that area bletoradiate stronger signals without increasing the power, examples of such techniques are beam forming, and multiple in put multiple-output (MIMO). These techniques enable high signal gains and may extend the reach of the signals but it also increases antenna sizes, and the complexity of antenna designs at both transmitters and receivers. This is evidenced by the study which concluded that performance degradationis proportional to antenna size.

The study has also highlighted some of the technical challenges that researchers should realize before approaching the technology. While massive MIMO and cell-free technologies are deemed to be some of the exciting innovations for the 5G communication paradigm, beam forming extends the use of such technologies by exploiting the broad range of antenna elements to provide high security, enhanced energy efficiency (EE), good communication reliability, and low signal processing complexity.

Cell-free technology is one of the areas that could adopt the beam forming technology to enhance the directivity and connectivity in wireless networks whereby a user is connected to severaldistributed antennas instead of the conventional systems to insure maximum sum rate reception.Subsequently, interference is considered the most destructive factor to wireless communication systems.Therefore ,the availability of proper channel models of the conventionalL TEcommunication system such as Rayleigh, Okumura- Hata etc. has made it easy for researchers to investigate and propose innovative ways to overcome the interference issue. Nevertheless, the existence of limited channel representation that precisely model 5G channels may have limited the availability of realistic simulation models.

In that regard, two famous channel models were developed to visualize and understand the signal behavior, namely: the third generation partnership project (3GPP) and

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New York university simulation (NYUSIM). On the other hand, electromagnetic radiations are generally categorized into non-ionizing radiations such as infra-red, microwave, radio frequency etc., and ionizing radiations such as X-rays. The non-ionizing radiations define the ones that have insufficient energy to break the atoms and turn them into ions, that is it does not cause any damages to the human body. Whereas the ionizing radiations at high doses increase the risks of cancer, birth and DNA defects etc. However, concerns of thermal heating caused by the electromagnetic radiations were raised. Therefore, the FCClimits the maximum exposure to radio frequency energy measured by the specific absorption ratio (SAR) to 1.6 watts per kilogram for mobile phones.The FCC approval indicates that the device will never exceed the maximum exposure levels, but itdoes not describe the consumers exposure during normal use .Given that, consumers may accidentally over heat a specific part of their body, for example head,torso,legsetc.while using their phones, for example talking forlong durations on thep hone.Therefore, manufacturers advise to keep phone conversations short,use ofplug-inearpieces,and that aminimumdistanceof5-20mmtobemaintainedbetweentheconsumer'sb odyandhis/herphone.Theserecommendationsm akeuswonderabouttheextentofthemaximumex posurethathumantissuescantolerateespeciallyw henconsideringcellularbasestationsthataredepl oyedontop of houses and at themiddle ofresidentialareas.

And while many people are happy with the pays of telecommunication companies for deploying cellular base stations on top of their houses, some are worried about the threats posed by these specially if the number of base stations is to be increased, for example in 5G communication systems. Despite the claims of the harmfulness of the electromagnetic signals, it can be said thatthrough directional transmission, consumers' concerns will be put to rest. Not only this, but quality of service will also be improved. Therefore, the motivation is to address the efforts ofsome researchers on beam forming methods which contribute to minimizing the radiations in all directions and enhance the network performance. The contributions are summarized as follows:

Enhancedunderstandingofinterferencein5G communication and beam forming method sthat achieves less interference(i.e. green communication). Summarized,yet efficient presentationontheimportant5Gchannelmodelli ngmodels.

The evaluations of different interference mitigation techniques provide clearer understanding of the effectiveness of beam forming techniques.

The presentation of different works on this issue promotes the work to be a reference for beam formingin future5Gsystems.

All signals in its basic form experience fading and undergo huge losses in the channel. To illustrate this, we look in which the wave propagation is described. In the base station has anomni directional antenna in which signals are propagating in all directions equally. In that sense, the user equipment are supposed to receive equal signal powers.

However, it is not achievable due to the unequal distance at which the users are located. On the other hand, user equipment receive much more improved signal powers when beams are not radiated equally in all directions which is done using different types of antennas. The terminology of forming the beams to a specific direction is familiarly known as beam forming.

The function used in beam forming determines the shape and the direction at which the beam is directed, that is number of antenna elements, their arrangement, the separation of elements, and the phase of each signal fedinto each antenna element. In that regard, the work presented in proposed a hybrid beam forming approach that is able to utilize the channel state information and come up with a beam steering map codebook. The approach attempts to mitigate the interference between the sub bands caused by the carrier offsets of the orthogonal frequency division multiplexing (OFDM).

Although the design seems to be complex, a digital beam former with regulated channel inversion was used to lower the complexity. In, a 5G-IOT smart virtual antenna array is designedtoeliminatetheinterferencebyprecisely directingthegeneralizedfrequencydivisionmult iplexing (GFDM) beams towards the targeted angles. Although the interference is mitigated, the performance raises few concerns due to the availability of limited higher frequencies channel models. On the other hand, the authors analyzed the end-fire arrangement arrays to combat interference in MIMO infrastructure in 12.9 GHz frequency band. OFDM techniques were also used to suppress the interference of in-band dull duplex channels. However, both reports did not discuss the performance in terms of bit error rates and throughput ratios. The smart antenna is another approach in which the antenna is able to construct a different beam for each user at the simultaneously.

The antenna can hop to any beam at any given time. With the aid of smart antennas, other techniques can be used to suppress the interference such as zero-forcing (ZF) of, or time division multiple access (TDMA) techniques in. In, a combined beam antenna that operates in 28 GHz frequency band is proposed. The design relies on combining two different radiating elements to obtaina wider beam that has ahighgain.

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On the azimuth plane, wider beams are obtained by micro strip patches while the higher gain is achieved using a wave-guide aperture in the elevation plane. Besides the reduced antenna size,the antenna can also constructively reduce interference by optimizing the radiation of the two radiating parts.In, an uplink interference computation algorithm was designed for 70 and 80GHz frequency bands to mitigate the interference by sectoring the cell zones and exclude certain zones from the transmission via switching off certain beams. Moreover, the spatial power control method helps in elevating the coverage area affects resulting from the beam on method. This also supports the fact that no coordination between the current and the 5G systems is needed. In, the interference in2.6GHz frequency band is mitigated using beam forming where by an array antenna consisting of 4 antenna elements that gives a 40 beam width was used. The proposed scheme relies on estimating the locations of the users by obtaining the angles of the users in relation to their respective fem to cells. Subsequently, the users are re-associated to the fem to cell that gives the highest interference plus noise ratio (SINR). Although the spectral efficiency and throughput were considerably enhanced, the interference occurrence probability can inflate indense deployment environments. The same authors in improved the performance by utilizing TDMA to time the transmissions instead of re-associating the users which improved the throughput even further and mitigated the outage probability to less than 5%.

Thedeploymentofwirelesscellularnetworksbackintheearly1980smadefeasiblecommunications via portable devices, thus decoupling call establishment from existing location.In the next decades, technological achievements such as data exchange, which was introduced in second generation (2G) wireless cellular networks, or multimedia communications, which was akey concept of third generation (3G) networks, enabled the delivery of even higher data rates to mobile users (MUs) and a more efficient spectrum utilization compared to second generation systems. In March 2009, the International Telecommunications Union-Radio communication ssector (ITU-R) specified a list of requirements for fourth generation (4G) systems, named the International Mobile Telecommunications Advanced (IMT-Advanced) specification, setting peak speed requirements for 4G services at 100 Mbs for high mobility communications (such as from trains and cars) and 1 Gbs for low mobility communications (such as pedestrians and stationary users).Theeraof3Gand4Gnetworkscoincidedwith scientific progressin other related fields,

Such as micro and power electronics, as well as hardware minimization and related improvements. This in turn made feasible the development of advanced transceiver architectures able to support among others large bandwidth operations and multiple Radio Frequency (RF)chains.

Therefore, a quite popular transmission technique that has been studied thoroughly over the previous two decades is the use of antenna arrays at both ends of a wireless orientation, also known as multiple input multiple output (MIMO). Research on MIMO systems was mainly boosted after the pioneering work of Alamouti.MIMO systems can provide, among other benefits, diversity and spatial multiplexing gain. In the first case, the same symbol information is sent and received over multiple antennas; hence, the mean Bit Error Rate (BER) is reduced, due to the presence of multiple diversity branches. In the spatial multiplexing mode, individual data streams are sent from different transmit antennas. Therefore, overall network throughput can be improved, at the cost, however, of increased hardware complexity, as the diversity order of the orientation is reduced. Although MIMO systems were incorporated in 3G and 4G standards, the increasing demand for even higher data rates as well as traffic congestion (i.e., total requested throughput per area) led the scientificcommunitytoseekadditionalbandwidthefficientsolutions.Observingtheevolutionofgenerations of mobile communication systems, one easily realizes that there is an endless quest for an equilibrium between serving the exponentially increasing user needs (global wireless traffic volume in 2013 increased 30 times compared to that in 2008 ), and developing innovative technologies to enhance operational capabilities and network capacity given the scarce spectrum(wireless communications capacity in 2008 has increased by one million times compared to1957).In this context, various solutions have been proposed for the deployment of 5G networks, such as mmWavetransmission ,massiveMIMO systems,non-orthogonal multiple access(NOMA)schemes as well as flexible network deployment along with nomadic nodes In the first case,mmWave spectrum overs the rangefrom30 GHzto300GHz(with equivalent wavelengths from 10 to 1 mm). This spectrum area is of particular interest forvariousreasons, as there is one order of magnitude of more spectrum available in this band than inlowerbands.Inaddition,largerbandwidthchannelscanbenowachieved(i.e.,of2GHz,4GHz,10 GHz, or even 100 GHz). Massive MIMO is an extension of multiuser MIMO, in which the base station(BS)transmitter simultaneously communicates with multiple mobile station(MS)receivers using the same time-frequency resources, improving the spectrum efficiency. Massive MIMO systems can have hundreds or even thousands of antenna channels in the array.

Finally, in NOMA schemes multiple users can share non-orthogonal resources in a synchronous way, thus achieving a higher spectral efficiency by allowing some degree of multiple access interference at mobile receivers .It becomes apparent from the above that accurate performance evaluation and radio network planning of 5Gsystem scan beaquitechallengingandcomputationally demanding procedure, since a considerable number of novel technologies is introduced compared to previous wireless protocols. In general, prior to the actual deployment ofa wireless cellular network, it is important to estimate a number of associated parameters, such as total capacity, maximum transmission rate both in uplink and downlink, delay, latency, outageprobability,etc.

Due to the large number of associated parameters (i.e., the number of active users, number of transmit/receive antennas, propagation environment, requested service per user, etc.), there are noanalytical solutions for such complex wireless cellular orientations.Hence,parameter estimation can be performed only numerically, via Monte Carlo (MC)simulations. Therefore, the goal of this review article is to provide all latest achievements on simulation platforms and techniques for 5G interfaces. In channel modeling issues for massive MIMO systems and mmWave transmission are discussed, along with simulation and evaluation procedures. Additional issues, such as Radio Network Planning (RNP) and integration of high bandwidth zero latency applications (e.g., autonomous driving in future electrical smart grids, network recovery after physical disasters, or bandwidth on demand in crowded areas)are discussed as well.With the demand increase of the capacity to mobile communication systems and scarce spectrum resources, smart antennas are used to resolve co-channel interference, multiple access interference,multipathfading and othe rissues,as anew application to airspace resource development The future fifth generation (5G) mobile network is aiming to provide a significant capacity ncrease ompared to any current cellular solutions. The demand for increased capacity in wireless networks motivated recent research toward wireless systems that exploit spaces electivity. A smart antenna consists of several antenna elements, whose signal is processed adaptively in order to exploit the spatial domain of the mobile radio channel.

Thesmartantennatechnologycansignificantlyimprovewirelesssystemperformanceandeconomicsforarangeofpotentialusers.Itenablesoperatorsofcellularandwirelesslocalloopnetworkstorealizesignificantincreaseinsignalquality,networkcapacityandcoverage.Smartantennashavebeenwidelyappliedinradar,sonar,mobileandsatellitecommunication,whichinhibittheinterferencefromdifferentdirectionsbybeamformingandeffici entlyimprovecellcoverageandsystemcapacity. Smartantennahasplayedapartinthe3rdGenerationofMobileCommunicationSystems(3G)standard,andthetechniquecanalsofindapplicationsinthenextgeneration(5G)cellularsystems.Manyresearchershavebeendesigned.Forexample,researchonantennadesignhasfocusedintheselectionofattractiveradiatingelementsandantennaarchitecture. Beam forming is a signal processing technique used in sensor arrays for directionalsigna ltransmission or reception.

Adaptive beam forming is techniques in which arrays of antennas are used to achieve maximum reception in the direction of desired user while signals of same frequency form other direction sare rejected. The user signal is multiplied by complex weights that adjust the magnitude and phase and amplitudes are adjusted to optimize the received signal. This causes the output of arrays of antenna to form transmit or receive in a particular direction and minimize the output in other direction. To change the directionality of the array when transmitting, a beam former controls the phase and relative amplitude of the signal at each transmitter, in order to create apattern of constructive and destructive interference in the wave front, adaptive beam forming algorithms LMS and RLS operation in MIMO smart antennas system is proposed. Moreover different convergence factors are used for the adaptive beam forming algorithms, and forgetting factors are also applied to each algorithm.

## 2. LITERATUREREVIEW

Extensivedeploymentoffifthgeneration(5G)communicationstartedtotakeplace infewcountriesaroundtheworld.Therefore,extensivestudiesonchannelmodellingandsignalmeasurementswithrespecttothephysicsfundamentalsareneededtoproperlydesignthearchitecture whereby such signals are precisely transmitted and received .The motivation of using such technology is that it promises higher data rates and enhanced network performance elative to the existingones.This is typically achieved by exploiting wider ranges of bandwidth in higher frequency bands, for example 30 Gigahertz (GHz). For instance, millimetre wavecommunicationprovidesupto10Terabits datarate sand spectral efficiency (SE) of approximately100 bps/Hzovera bandwidth of about270 Megabits per second(Mbps).

**S.Wang,Y.Wang,B.Xu,Y.Li,andW.Xu:**

We investigate the capacity performance of an in-band full-duplex (IBFD) amplify and forward two-way relay system under the effect of residual loop-back-interference (LBI). In a two-wayIBFD relay system, two IBFD nodes exchange data with each other via an IBFD relay. Both two-way relaying and IBFD one-way relaying could double the spectrum efficiency theoretically. However, due to imperfect channel estimation, the performance of two-way relaying is degraded by self-interference at the receiver. Moreover,the performance of theIBFD relayingisdeteriorated by LBI between the transmit antenna and the receive antenna of the node. Different from the IBFD one-way relay scenario, the IBFD two-way relay system will suffer from an extra level of LBI at the destination receiver. We derive accurate approximations of the average end-to-end capacities for both the IBFD and half-duplex modes. We evaluate the impact of the LBIandchannelestimationerrorsonsystemperformance.MonteCarlosimulationsverifythevalidityofanalyticalresults. It can be shown that with certain signal-to-noise ratio values and effective interference cancellation techniques, the IBFD transmission is preferable in terms of capacity.TheIBFD two-way relaying is an attractive technique for practical applications.

**Z.Zhao,M.Xu,Yong Li,and M.Peng**

A key problem of content caching networks is that extra radio resource blocks are consumed to push content objects, which leads to a decline of spectrum efficiency. To solve this problem, anon-orthogonal multiple access-based multicast (NOMA-MC) scheme is proposed in this paper, where pushing and multicasting content object scan be accomplished simultaneously, and thus the spectrum efficiency can be improved significantly. To evaluate the performance of the NOMA-MC scheme, an explicit expression of outage probability is derived, which shows that full diversity gain scan be achieved in the single-cell scenario .Moreover ,the theoretical result scan be extended to the multi-cell scenario by establishing a stochastic geometry-based network model, which show that the NOMA-MC scheme can achieve better performance than the conventional orthogonal multiple access-based multicast scheme. Then, the joint design of power allocation and content matching is studied to enlarge the performance gains of the NOMA-MC scheme, and two distributed optimization algorithms are proposed by solving a hospitals/residents matching problem.Finally,simulation results are provided to verify the analytical results, and also demonstrate the performance gains of the NOMA-MC scheme.

**D.L.Duttweiler**

On typical echo paths, the proportionate normalized least-mean-squares (PNLMS) adaptationalgorithmconvergessignificantlyfasterthanthenormalizedleast-mean- squares (NLMS)algorithm generally used in echo cancellers to date. In PNLMS adaptation, the adaptation gain a teach tap position varies from position to position and is roughly proportional at each tap position to the absolute evalue of the current tapweightestimate.Thetotaladaptationgainbeingdistributed over the taps is carefully monitored and controlled so as to hold the adaptation quality(misadjustment noise)constant.PNLMS adaptation only entails a modest increasein computational complexity.

**Y.Chen,Y. Gu,andA.O.Hero:**

We propose a new approach to adaptive system identification when the system model is sparse. The approach applies l1 relaxation, common in compressive sensing, to improve the performance of LMS-type adaptive methods. This results in two new algorithms, the zero-attracting LMS(ZA-LMS) and the reweighted zero-attracting LMS (RZA-LMS). The ZA-LMS is derived via combining a l1 norm penalty on the coefficients into the quadratic LMS cost function, which generates a zero attract or in theLMS iteration. The zero attract or promotes sparsityintaps during the filtering process, and there for eacceleratesconvergencewhenidentifyingspars esystems.WeprovethattheZA- LMScan achieve lower means quareerr or than the standard LMS.To further improve the filtering performance, the RZA-LMS is developed using a reweighted zero attractor. The performance of the RZA-LMS is superior to that of the ZA-LMS numerically. Experiments demonstrate the advantages of the proposed filters in both convergence rate and steady-state behavior under theresparsity assumptions on the true coefficient vector. The RZA-LMS is also shown to be robust when the number of non-zero taps increases.

**EmmanuelJ.CandesMichael B.Wakin:**

Stephen P. Boyd: It is now well understood that it is possible to reconstruct sparse signalsexactlyfromwhatappeartobehighlyinco mpletesetsoflinearmeasurementsandthatthisca nbe done by constrained 1 minimization. In this paper, we study a novel method for sparse signal recovery that in many situations outperforms 1-minimization in the sense that substantially fewer measurements are needed for exact recovery. The algorithm consists of solving sequence ofweighted 1-minimization problems where the weights used for the next iteration are computed from the value of the current solution. We present a series of experiments demonstrating there markable performance and broad applicability of this algorithm in the areas of sparse signal recovery,statistical estimation, error correction and image processing.

## 3. EXISTING METHOD

### 3.1 Introduction

For the last several years, adaptive beam forming plays an important role in sensor array systems in countering interference outside of the direction of interest.However,calculation of the adaptive weights generally requires a large number of operations that rapidly grows with the number of antennas. Consequently, a large number of programmable processors is commonly required to calculate the weights, which in some systems may present excessive weight, volume and power requirements. An algorithm is presented for the detection of users in the smart antenna system, which appliedminimumbiterrorratebeamformingwith interferencecancellation at the BS side to enhance the capacity. In SA-MIMO system, each antenna of MIMOis replaced bya smart antenna array.

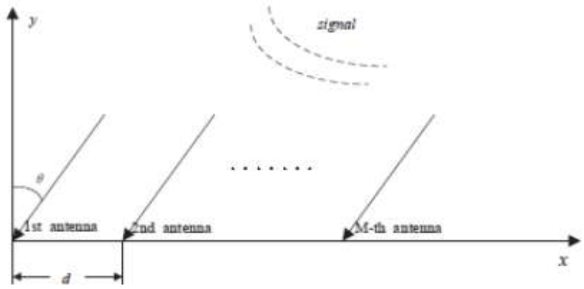
### 3.2 EXISTING METHOD

The inner product correlation matrix is dealt with a modified mean square error detection scenario based ordering successive nterferencecancellation.Inthe5G,anappropriate beam forming scheme to focus the transmitted and received signal in a desired direction in order to overcome the unfavorable path loss in one of the key enablers for cellular communications atmmWave frequency bands. The hybrid beam forming architecture inmm Wave bands are presented in. In order to support this new paradigm, shift in mobile communication radically new solutions for the air interface need to be developed.One of the critical challenges that the mobile industry will face is inter-cell interference due to the expected significant cell densification in order to support the required 10-fold increase in spectral efficiency. Beam forming algorithm based on the beam reference signal may include the formation of signal, DOA and the blind beam forming.

## 4. PROPOSED METHOD

### 4.1 Introduction

Uniform linear array (ULA) is used to simplify the optimization problem and analyze algorithm performance. The signals are narrow band and can be seen as plane wave at receive end. In the model, the arrays are arranged in a line with equal intervals. The angle of incidence θ is the angle between DOAand y axis.




Uniformlineararray

The array consists of M antennas and is used to receive m signals, including SOI, interferences and noise. We assume there are one SOI and m ( $0 \le m < M$) interferences. The incident angles of SOIand interferences $\theta_0$and$\theta_i$=(i=1,2,3,….,m)are expressed as and respectively. IntheULA,it is assumed that the distance between two adjacent antennasdis$\frac{\lambda}{2}$( λis the signal wavelength).Then the phase difference between the two adjacent antennas isπsinθ

We use the first antenna as a reference. When the incident angle is

Then the whole steer vectorisa= [a($\theta$0),a($\theta$1),….,a($\theta m$)]

In order to construct transmitted signal, we use N denote signal length and x(n) denote the n-th snapshot with n ranges from 1 to N.

Then the whole signalx is expressed as below

x=[x(1),x(2),…..,x(N)]

=a*S +$v$

where Sis a[(m+1)xN]

signal matrix that contains oneSOIandminterferences'v'donatestheadditivewhiteGaussiannoise(AWGN).It is assumed to be independent from SO Iand interferences.

In this paper, we propose a new algorithms in LCMV. LCMV criterion takes the output power as cost function. It was first proposed by Frost. And it works well in anti-interference. But the convergence rate contradicts with steady state. Many researchers have done a lot to improve the algorithm. However, there still needs more works to push it further. On this point, motivated b,we propose a new method on the basis of LCMV. Log-sum penalty is imposed on the cost function.We get the final formulation through mathematical derivation. Compared with traditional singly linearly constrained LMS, simulations are carried out to prove the new method's superiority. Themethodoutperformsothermethodsinconver $\theta k$=(k=0,1,2,….,m)thecorrespond gencerateandsteadystate.Notations:Inthefollowing parts, the superscripts $(.)^H$and $(.)^{-1}$denote the transpose and inverse operators,respectively.E[.]denotestheexpectation operator ands ign[.]is thec omponent-wisesignfunctiondefinedas below

$\frac{x}{}$, $x \neq 0$

sign|x|={$|x|$

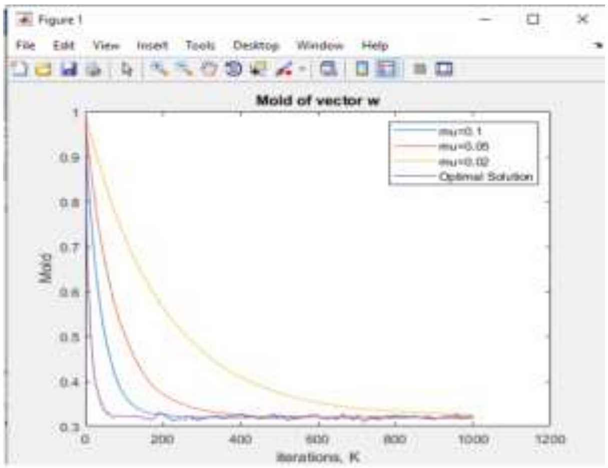
0, $x$=0

## 5 PROPOSED ALGORITHM

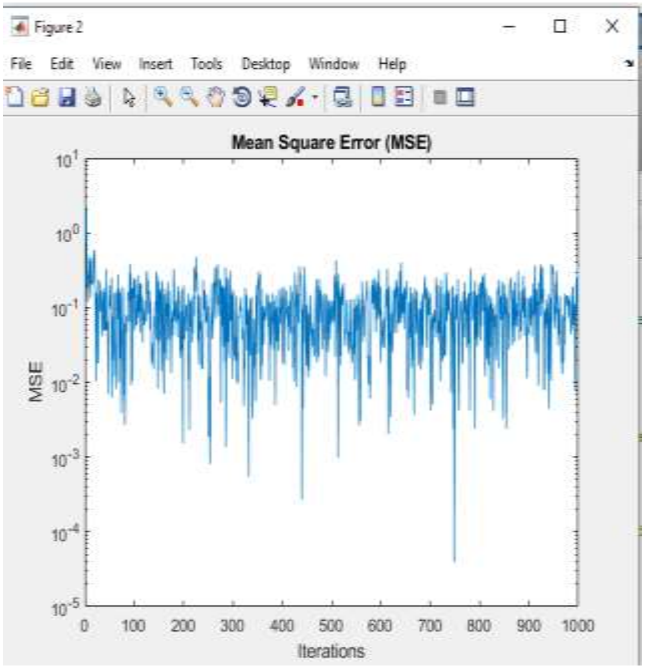
On the basis of traditional, singly linearly constrained least mean square(LC-LMS), we introduce a log-sum penalty on the coefficients and addition to the cost function. We derive the iterative formula of filter weights. By simulations in antenna environment with signal of interest ,noise and interferences. In this part, we give the specific derivations of the new algorithm.

The newly proposed algorithm adds log-sum penalty to the object function on the basis of LC-LMS.The optimization problem is expressed as follows LogSumLC-LMS algorithm is well suited for interference-coexistence communication.

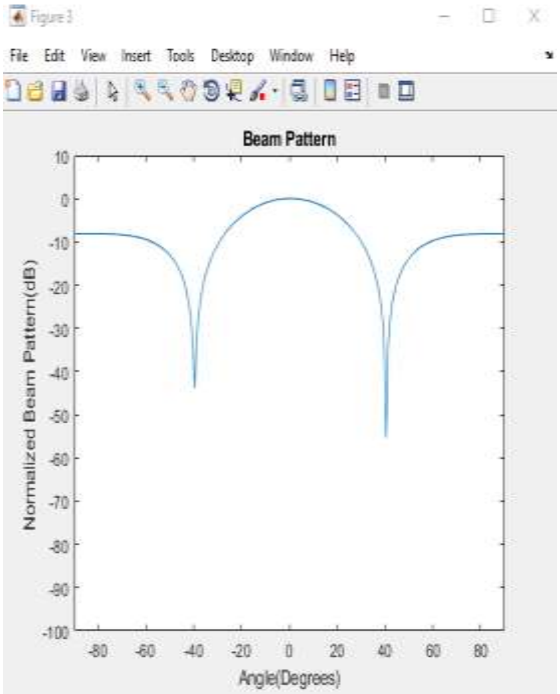
## 6. RESULTS




Mold of vector w




Mean Square Error




Beam Pattern

## 6.CONCLUSION

We proposed a new algorithm based on the LC-LMS. We add log-sum penalty to the objectfunctionandgivetheoreticalanalysisstepbystepuntilderivethefinalformula.Thenexperiments are carried out on MATLAB platform. The first experiment aims to compare the newly proposed algorithm with LC LMS in convergence rate and steady state. The results prove the effectiveness and superiority of the new method. In the second experiment, we analyze the factors that may affect the performance of the method.

## REFERENCES

1.S. WANG, Y. WANG, B. XU, Y. LI, and W. Xu, "Capacity of two-way in-band full-duplexrelaying with imperfect channel state information," IEICE Trans. Communication., vol. E101-B,no.4, pp. 1108–1115, Apr. 2018. S. Wang, D. D Wang, C. Li, and W. B Xu. "Full Duplex AF and DF Relaying Under Channel Estimation Errors forV2VCommunications,"IEEE Access.vol.6, Nov., 2018.

2. Z. Zhao, S. Bu, T. Zhao, Z. Yin, M. Peng, Z. Ding, and Tony Q. S. Quek, "On the design ofcomputationoffloadinginfogradioaccessnetworks,"toappearinIEEETrans.OnVeh.Technol.

3. Z. Zhao, M. Xu, Yong Li, and M. Peng, "A non-orthogonal multiple access-based multicastscheme in wireless content caching networks," IEEE J. Sel. Areas Communication., vol. 35, no.12, pp.2723-2735, July 2017.

4. B.WidrowandS.D.Stearns,AdaptiveSignalProcessing,NewJersey:PrenticeHall,1985.

5. D.L. Duttweiler, "Proportionate normalized least-mean squares adaptation in echo cancelers,"IEEETrans. Speech Audio Process., vol. 8, pp.508C-518, 2000.

6. W.Y. Chen, R.A. Haddad, "A variable step size LMS algorithm," Proceedings of the 33rdMidwestSymposiumonCircuits and Systems, 1990, pp. 636–640.

7. Zhang Yuan, Xi Songtao, "Application of New LMS Adaptive Filtering Algorithm withVariableStepSizeinAdaptiveEchoCacellation".17thIEEEInternationalConferenceonCommunicationTechnology, 2017

8. Y. Chen,Y.Gu,and A. O. Hero, "Sparse lms for system identification," in Proceeding of theIEEE International Conference on Acoustics, Speech and Signal Processing, 2009, pp. 3125–3128.

9. O. L. Frost, "An algorithm for linearly constrained adaptive array processing," Proceedingsofthe IEEE,vol. 60, no.8, pp. 926-C935, 1972.

10. E. J. Cand' es, M. Wakin, and S. Boyd, "Enhancing sparsity by reweighted l1 minimization,"Toappear in J. FourierAnal. Appl.