

An Energy Efficient Multicast Scheduler for Multicast Protocol WEEM in Ad Hoc Networks



Subhankar Ghosh¹, Dr. Anuradha Banerjee²

¹Regent Education and Research Foundation, India, redhatsubha@gmail.com

²Kalyani Govt. Engg. College, India, anuradha79bn@gmail.com

ABSTRACT

Multicasting is an important operation in ad hoc networks. In this operation, a group of nodes termed as multicast members, are expected to receive same multicast message, at approximately same time if possible. They may be physically close or placed far apart. Earlier we have proposed the multicast scheduler WEEM. The present article proposes an energy efficient scheduler exclusively for WEEM in ad hoc network environment. Based on the advantages provided by underlying network architecture, a router can efficiently schedule multicast packets belonging to various multicast sessions. This promotes greenery in the network and significantly increases packet delivery ratio. These claims are supported and justified by experimental results presented in this paper. As far as the authors know, there is no multicast packet scheduler in the literature of ad hoc networks. Therefore, current approach of multicast scheduler design is novel and state-of-the-art.

Key words : Ad hoc networks; Energy efficiency; Fuzzy scheduler; Multicasting.

1. INTRODUCTION

A mobile ad hoc network consists of certain nodes that communicates via wireless links without any network infrastructure or centralized administration the nodes are free to move in arbitrary direction and arrange them in time – varying network topologies. These are particularly used in emergency scenarios like war, natural disaster etc [1]-[6]. Communication in ad hoc network either single-hop or multi-hop. In a single hop communication, destination stays within radio-range of source. On the other hand in multi-hop network, one or more routers have to bridge the gap between source and destination nodes.

As far as the authors know, no scheduler has yet been developed exclusively for multicast operation in ad hoc networks. Earlier we have developed a Weight-based Energy Efficient Multicast protocol (WEEM) [9] where packets were processed by routers in first-come-first-served or FCFS basis. Here we applied a different scheduling strategy named Energy Efficient Multicast Scheduler EEMS-WEEM particularly for the protocol WEEM, while the ethnic WEEM is referred to as FCFS-WEEM. EEMS-WEEM [10] is a weight based scheme that assigns higher weight to packets travelling through a path consisting of exhausted routers and expected to deliver multicast message to a good number of multicast destinations. Priority of the packet increases even more if it is part of a multicast session that has already suffered a huge number of route discoveries. Based on these observations, a fuzzy

controller FUZZ-EEMS [7] is designed which is embedded in every node. This computes priority of each multicast packet [8].

2. RELATED WORK

Please note that there is no scheduler in literature of ad hoc networks that focus on multicast operation. Therefore, we discuss scheduling algorithms in general. Different routing protocols use different methods of scheduling. Among them, FCFS (first-come-first-served) is quite heavily used. This processes broadcast packets in order of arrival [1]. Priority scheduler is based on either internal or external priority. But these do not consider typical natures of different kinds of communication (unicast, multicast, broadcast, anycast) of ad hoc networks.

Certain scheduling schemes depend on the size of the message and number of hops to traverse. In smallest message first (SMF) [2] algorithm, packets that are part of smallest message are processed first. In order to implement this requires total message size to be attached to each packet. In smallest remaining message first scheme (SRMF) [3], [4] packets are ordered on the basis of the amount of message packets remaining to be sent after the current packet. On the other hand, in shortest hop length first (SHLF) scheduling [5], [6] the distance between the source and destination, measured in terms of the number of hops.

3. THE SCHEME OF EEMS-WEEM

Let a given packet pac be travelling through a route R_{pac} such that WEEM calculated its priority to be $weight(R_{pac})$. Also assume that $dest(R_{pac})$ is number of multicast destinations present in the route R_{pac} .

3.1 Input parameters of FUZZ-EEMS

Input parameters $par1$, $par2$ and $par3$ of FUZZ-EEMS are as follows:

$$par1 = 1 - f(pac) / \text{MAX} \{f(pac1)+1\} \quad (1)$$

$$pac1 \in \text{competitor}(pac)$$

$$f(pac) = \text{weight}(R_{pac}) / \text{dest}(R_{pac}) \quad (2)$$

$f(pac)$ of a packet pac expresses i) residual energy (above threshold energy which is 40% of initial energy as mentioned in WEEM) of routers in R_{pac} through which pac is supposed to travel, and ii) multicast packet transmission capability of routers in R_{pac} . As per reference [9], multicast packet transmission capability is the number of multicast packets that



Anycast Scheduler For Ad Hoc Networks

Subhankar Ghosh¹, Dr. Anuradha Banerjee²

¹Regent Education and Research Foundation, India, redhatsubha@gmail.com

²Kalyani Govt. Engg. College, India, anuradha79bn@gmail.com

ABSTRACT

Area anycast is a very specialized operation in scalable wireless ad hoc networks. In this operation a group of nodes belonging to a pre-specified network region, are capable of receiving Area anycast message. Here anycast source communicates with most eligible destination within the anycast region. By most eligible destination we mean the one that has higher probability in residing within anycast region for a long time, hopefully till the end of anycast communication session. This requires clustering where a node outperforms another by its merit. All the clusterheads send route-reply packet to the anycast source and based on number of hops travelled by these route-reply packets, only one eligible destination is elected by the source. As far as scheduling of packets is concerned, we schedule unicast, multicast, broadcast and anycast packets separately. In this article, we have illustrated scheduling scheme for anycast packets only. The scheme has been compared with first-come-first-served or FCFS and longest hop-length first or LHLF. Simulation results demonstrate that our scheme anycast-scheduler or ANSCHED performs much better than FCFS and LHLF.

Key words: Ad hoc networks; Energy efficiency; Fuzzy Sets; Anycasting.

1. INTRODUCTION

A mobile ad hoc network is an infrastructure less network where the nodes are free to move independently in any directions. It is a collection of mobile devices or nodes that collaborate with each other to bridge the gap between a given pair of source and destination nodes where the destination is outside radio range of source. These networks are extremely important for rescue services in battle field and natural disasters like flood, earthquake etc, where quick deployment and mitigation are necessary.

The routing protocols proposed for ad hoc networks, can be broadly divided in to proactive and reactive routing protocols.

In proactive routing protocols nodes proactively store route information to every other node of the network, in a table.

This is not practical for large and scalable networks where number of nodes is huge. This will lead to huge storage overhead, because information is stored about both active and inactive routes.

Reactive protocols reduce this overhead by inculcating the energy cost of route discovery. In these protocols route request packets are broadcast in the network and as soon as one reaches the designed destination, it generates route reply and sends that back to source. This network wide flooding is very costly and therefore, we need to implement ad hoc networks in energy efficient manner. Energy save means increase in lifetime of routers and higher network throughput.

Anycast is an operation where source intends to deliver a set of message packets to any one node within a predefined region. A router might have to schedule multiple anycast packets if more than one anycast packets arrive at it. The scheduler is fuzzy controlled with priorities based on distance from selected destination, amount of pending work that is, number of packets yet to be forwarded and distance between current router and nearest node in anycast region. Please note that the nearest node in anycast region may or may not be equal to the elected destination.

The article is organized as follows. Section 2 specifies related work. Formulation of input parameters of fuzzy controller ANSCHED appears in section 3. Section 4 demonstrates fuzzy rule bases of it while simulation results are shown in section 5. Section 6 concludes the paper.



2. RELATED WORK

Please note that there is no scheduler in literature of ad hoc networks that focus on particularly anycast operation. Therefore, we discuss scheduling algorithms in general. There are different scheduling policies for different network scenarios. Different routing protocols use different methods of scheduling. Among them, FCFS (first-come-first-served) is quite heavily used. The drop-tail policy is used as a queue management algorithm in various scheduling algorithms for buffer management [1]. Except for the no-priority scheduling algorithm, all other scheduling algorithms give higher

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Automatic Language Identification using Basic Signal Class

Panchanan Suparna, Saha Arup, Datta Asoke Kr

Abstract

Automatic language identification (ASLID) is a problem of identifying an unknown language from spoken utterance by a computer. A segmental approach to ASLID based on the assumption that the acoustic structure of languages can be estimated by segmenting speech into three basic classes of speech signals. This paper presents a procedure of ASLID with the details of methodology and the results without recognizing the words, but the lengths segments of three basic classes of signals namely, quasi-periodic (free voice vowels, obstructed voice, e.g., murmurs, laterals), quasi-random (noise segments, sibilants, frictions in affricates) and quiescent (plosives and affricates, silent periods, occlusions as well as silences caused by breath pause). The quasi-periodic class is again classified as fully voiced signals, obstructed vocalic signals. The classifier uses features from these four classes, which are extracted with more than 98.6% accuracy. The study is conducted with standard dialects of sixteen spoken languages namely Assamese, Bengali, Hindi, Marathi, Gujarati, Panjabi, Urdu, Malayalam, Odia, Konkani, Maithili, Kannada, Manipuri, Nepali and Telugu. The sixteen languages have been chosen in such a manner so that it covers all most all the states of India. The corpus mainly contains the spontaneous speech in conversational mode on various topic, viz. agriculture, social welfare, personal interview, etc. spoken by both sexes. The database consists of more than 30 minutes of spoken data for each of these dialects. The corpus has been collected from the regional radio broadcast. It is expected that the relative abundance of the aforesaid signal classes is different for different languages. Hence, a unique pattern is expected to be observed across the languages. Hence, the collected database is evaluated with Relative Abundance Model (RAM) using weighted Euclidean distance classifier. Here, we are proposing a model which explores the spoken data using time domain parameter. The uniqueness of this model is that it does not use any normally used linguistic information. It is observed that variation of segmental duration of the aforesaid signal types is present in different languages. Exploiting the above phenomenon RAM has been developed. With these sixteen languages of three language families, viz. Indo-Aryan, Dravidian and Tibeto-Burman the recognition rate of 70% has been achieved.

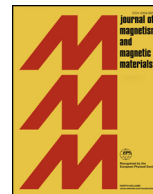
Keywords: *Automatic language identification, basic signal class, relative abundance model, speech, acoustic, phonetics, equal error rate, Euclidean distance classifier*



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Research articles

Investigation of cationic disorder effects on the transport and magnetic properties of perovskite $\text{Pr}_{0.7-x}\text{RE}_x\text{Sr}_{0.3}\text{MnO}_3$ ($x = 0.0, 0.2$; RE = Nd, Sm, & Gd)Anand Pal^a, Ashok Rao^{a,*}, Dhananjaya Kekuda^a, B.S. Nagaraja^b, Rittwick Mondal^c, Dipankar Biswas^d^a Department of Physics, Manipal Institute of Technology, Manipal Academy of Higher Education, Manipal 576104, Karnataka, India^b Department of Physics, N.M.A.M. Institute of Technology, Nitte 574110, Karnataka, India^c Edrakupur High School, Birbhum, West Bengal 731219, India^d Regent Education and Research Foundation, Barrackpore, Kolkata 700121, India

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ABSTRACT

The strong influence of the A-site cationic size mismatch on the electrical, thermal and magnetotransport properties of $\text{Pr}_{0.7-x}\text{RE}_x\text{Sr}_{0.3}\text{MnO}_3$ ($x = 0.0, 0.2$; RE = Nd, Sm & Gd) perovskite compound has been reported here. The considerable shifting of the insulator to metal transition temperature (T_{IM}) with the partial substitution of Pr^{3+} ions by smaller radii rare-earth ions is discussed. The relevance of electron-electron scattering and the application of an adiabatic small polaron hopping (ASPH) model is explained to analyze electrical data. The temperature dependent volume fraction of the metallic ferromagnetic phase obtained from the percolation model of the electrical resistivity demonstrated a well resemblance with magnetic data. Analysis of Thermoelectric Power (TEP) data reveals that electron-magnon scattering is responsible for the thermoelectric transport in the metallic region whereas high temperature insulating region above T_p is well explained by the non-adiabatic SPH model.

1. Introduction

In recent years, perovskite manganese oxides with a general formula $\text{RE}_{1-x}\text{A}_x\text{MnO}_3$, where RE is trivalent rare-earth (La, Pr, Nd, ...etc.) and B a divalent (Ca^{2+} and Sr^{2+}), have become prototypical system to study a variety of physical and structural properties [1–5]. The double exchange (DE) interaction between Mn^{3+} and Mn^{4+} ions mediated by oxygen ion along with strong electron-phonon interaction arising from the Jahn-Teller distortion of the MnO_6 octahedra gives rise to a variety of exciting property in these materials [6,7]. A lot of fascinating physical phenomenons, such as colossal magneto-resistance (CMR), insulator-metal transitions, and magneto-caloric effect (MCE) has been observed in these materials by tuning the electron-electron and electron-lattice interaction with different kinds of perturbations [8–10]. The excellent physical properties and easy tuning of them raise the hope for these materials as potential candidates for efficient devices such as magnetic recording devices, magnetic actuators, and sensors [11–14].

For the incorporation of the material in the device, it is essential to

have a deeper understanding of their physical properties under the influence of different perturbations, which may provide a fine control and manipulation of devices. The unusual properties of these materials can be achieved by introducing the cations of different size in the perovskite structure, without changing the valence state of Mn ions [15]. It was suggested that the random disorder of RE^{3+} and A^{2+} cations distributed over the A sites in the perovskite structure is a crucial parameter to manipulate the transition temperature and magnetoresistance in these materials [16–18]. The cation disorder modifies Mn-O bond length, and Mn-O-Mn bond angle, consequently, alters the electron hopping between Mn ions. Therefore, it would be interesting to investigate the effect of cationic disorder in the physical properties of these materials. Among all the family of manganite perovskite compounds, $\text{Pr}_{0.7}\text{Sr}_{0.3}\text{MnO}_3$ has attracted particular interest due to its large magnetic moment, sharp electrical and magnetic transitions, and high magnetoresistance at low fields [19]. Recently, we have studied and reported the effect of La substitution by smaller rare-earth ionic radii in $\text{La}_{0.67-x}\text{RE}_x\text{Ca}_{0.33}\text{MnO}_3$, in which we demonstrated a significant enhancement in TCR and MR values [20].

* Corresponding author.

E-mail address: ashokanu_rao@rediffmail.com (A. Rao).<https://doi.org/10.1016/j.jmmm.2020.167011>

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Study of microstructure and electrical conduction mechanisms of quaternary semiconducting glassy systems: Effect of mixed modifiers

Dipankar Biswas^{a,b}, Anindya Sundar Das^{c,*}, Rittwick Mondal^d, Anindita Banerjee^e, Debalina Deb^f, Abhigyan Dutta^e, Subhratanu Bhattacharya^f, Soumyajyoti Kabi^g, Loitongbam Surajkumar Singh^b

^a Department of Electronics & Communication Engineering, Regent Education and Research Foundation, Barrackpore, Kolkata 700121, West Bengal, India

^b Department of Electronics & Communication Engineering, National Institute of Technology Manipur, Langol, Imphal 795004, India

^c Department of Electronics & Communication Engineering, Swami Vivekananda Institute of Science & Technology, Dakshin Gobindapur, Kolkata 700145, West Bengal, India

^d Department of Basic Science, Edrakpur High School, Birbhum, West Bengal 731219, India

^e Department of Physics, The University of Burdwan, Burdwan, West Bengal 713104, India

^f Department of Physics, University of Kalyani, Kalyani, Nadia, West Bengal 741235, India

^g Department of Physics, Hijli College, Kharagpur, West Bengal 721306, India

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ABSTRACT

In this work, we have investigated microstructural, optical properties, and electrical conduction mechanism of two ternary and four quaternary glassy systems of $0.65\text{ZnO}-0.1\text{P}_2\text{O}_5-0.25 [x\text{TeO}_2-(1-x)\text{MoO}_3]$ composition to uncover a more reliable semiconductor nanocomposite system for various types of suitable applications. XRD patterns and TEM micrographs reveal the presence of amorphous phases with a few superposed nanocrystallites. The optical bandgap energy (E_{opt}) values, obtained from UV-Vis spectra, vary with TeO_2 concentration (x), and an inverse relationship between E_{opt} and average nanocrystallite size (d_c) is identified. It is detected that DC and AC conductivity increase as temperature rises, manifesting a semiconducting feature. DC conductivity shows non-linearity and caused by the small polaron hopping process, whereas the modified correlated barrier-hopping (CBH) model is the applicable mechanism for AC conductivity. Scaled spectra of conductivity unveil that the conductivity relaxation process depends on the composite structure and does not depend on temperature.

Introduction

As an emerging photonic material, the phospho-tellurite glassy system owing to its optical and structural properties has great applicability in various areas such as optoelectronics and photonics like sensors, optical amplifiers, optical limiters, laser technologies, etc. [1,2]. Tellurium-doped semiconductor glass systems (TeO_2) have been widely considered over the past two decades due to the high value of the linear and nonlinear refractive index, the wide transmission range, the observed nonlinear optical property, the higher chemical stability, and thermal properties [3-5]. A pure TeO_2 usually recognized as a conditional glass-former as it does not form a glass straightforwardly and requires one or more oxides, which act as glass formers, modifiers, and intermediates like MoO_3 , Bi_2O_3 , CdO , ZnO , BaO [1-5], etc. The main challenges to obtain high- TeO_2 content glasses are due to the inclination toward large crystallization, separation of phase on cooling,

compositional change for volatilization of tellurite on melting ($> 700^\circ\text{C}$), difficulty to obtain bulky samples, and also chemical corrosion of the aluminum and silica crucible. The addition of a small amount of metaphosphate can improve the glass-forming ability of the tellurite network [3,6]. The development of tellurite based glassy systems using the well-established quench of melt technique can be drastically improved by P_2O_5 doping as glass-forming oxide, MoO_3 as metal oxide modifier, and ZnO as an intermediate transition metal oxide [7]. Incorporation of these types of metal oxides within the glassy systems provides an escalation to good nonlinear optical properties [8]. MoO_3 doped phosphate glassy systems exhibit electro-optical applications caused by electrochromism properties and higher ionic conductivity [9,10]. The molybdate doped glassy systems are also very useful for modulation of light, higher-density memories, smart windows type large display devices, and some other electrochromic systems [11]. Normally, four different oxidation states are observed in molybdenum,

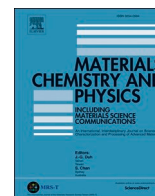
* Corresponding author. Department of Electronics & Communication Engineering, Swami Vivekananda Institute of Science & Technology, Dakshin Gobindapur, Kolkata 700145, West Bengal, India

E-mail address: anindyasundardas03@gmail.com (A.S. Das).

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Temperature and frequency dependent electrical conductivity and dielectric relaxation of mixed transition metal doped bismuth-phosphate semiconducting glassy systems

R.K. Nanao Ningthemcha^a, Dipankar Biswas^{a,b,*}, Yumnam Bonney Singh^a,
Deepanwita Sarkar^b, Rittwick Mondal^c, Debabrata Mandal^d, Loitongbam Surajkumar Singh^a

^a Department of Electronics & Communication Engineering, National Institute of Technology Manipur, Langol, Imphal, 795004, India

^b Department of Electronics and Communication Engineering, Regent Education and Research Foundation, Barrackpore, Kolkata, 700121, India

^c Department of Basic Science, Edrakpur High School, Birbhum, West Bengal, 731219, India

^d Department of Physics, Indian Institute of Technology, Kharagpur, West Bengal, 721302, India

HIGHLIGHTS

- Composition-dependent physical parameters such as density and molar volume are investigated.
- XRD patterns reveal amorphousness of the samples with the presence of a certain amount of crystallinity.
- DC conductivity has been analyzed using Mott and Greaves's variable range hopping model.
- Modified Correlated barrier hopping (CBH) mechanism applies to the AC conductivity process.
- Dielectric constant and dielectric loss values reduce with increasing frequency and increase with temperature rise.

ARTICLE INFO

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Correlated barrier hopping (CBH)
Conductivity relaxation process

ABSTRACT

Two ternary and three quaternary glass nanocomposites with a general chemical formula $0.45\text{Bi}_2\text{O}_3 - 0.15\text{P}_2\text{O}_5 - (0.4-x)\text{V}_2\text{O}_5 - x\text{MoO}_3$ ($x = 0, 0.1, 0.2, 0.3, \text{ and } 0.4$) are synthesized through melt quenching method. Few nanophases $\text{Bi}_5\text{PO}_{10}$, V_2O_5 , BiVO_4 , $\text{Bi}_{12}\text{P}_2\text{O}_{23}$, $\text{Bi}(\text{PO}_3)_3$, $\text{Bi}_{13}\text{Mo}_4\text{VO}_{34}$, Mo_4O_{11} , MoOPO_4 , Bi_4MoO_9 , and $\text{BiP}_5\text{O}_{14}$ are superimposed within glass matrices acknowledged from XRD patterns. The Almond-West formalism is used to study the electrical conductivity of mixed transition metal-doped bismuth-phosphate glass nanocomposites. The semiconducting non-linear characteristics are established from the dc conductivity curve and the different values of activation energies in high and low-temperature regions. The dc conductivity of each glass nanocomposite has been explained by the Mott and Greaves's variable range hopping model. The reducing nature dc conductivity with the rise of MoO_3 content is elucidated from the estimated values of small polaron hopping energy (W_{hop}) and hopping distance (R_{hop}). Modified correlated barrier hopping model flawlessly defines the mechanism of ac conductivity as the value of power-law exponent reduces with temperature. The effect of temperature and frequency on the dielectric properties of the samples has been intensely investigated. Non-Debye type of relaxation process of dynamic conductivity is predicted and the relaxation time exhibits Arrhenius characteristics.

1. Introduction

Phosphate glasses are both technologically and scientifically significant materials since they offer some inspiring physical properties which are superior to those of different glasses, for example, higher coefficients of thermal expansion, lower melting and glass transition temperatures,

and higher electrical conductivity at low-temperature range [1]. These types of characteristics make them suitable candidates for better ion-conducting materials and additional important applications such as energy converters, optical fibre amplifiers, laser hosts, bio-compatible materials, and optoelectronic-devices [2,3]. But these glasses have a moderately poor chemical strength [4] that often confines their

* Corresponding author. Department of Electronics & Communication Engineering, Regent Education and Research Foundation, Barrackpore, Kolkata, 700121, India.

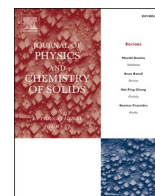
E-mail address: dipankar_aec@rediffmail.com (D. Biswas).

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Structural properties and electrical conductivity mechanisms of semiconducting quaternary nanocomposites: Effect of two transition metal oxides

Dipankar Biswas^{a,b}, Anindya Sundar Das^{c,*}, Rittwick Mondal^d, Anindita Banerjee^e, Abhigyan Dutta^e, Soumyajyoti Kabi^f, Debasish Roy^g, Loitongbam Surajkumar Singh^b

^a Department of Electronics & Communication Engineering, Regent Education and Research Foundation, Barrackpore, Kolkata, 700121, West Bengal, India

^b Department of Electronics & Communication Engineering, National Institute of Technology Manipur, Langol, Imphal, 795004, India

^c Department of Electronics & Communication Engineering, Swami Vivekananda Institute of Science & Technology, Dakshin Gobindapur, Kolkata, 700145, West Bengal, India

^d Department of Basic Science, Edrakpur High School, Birbhum, West Bengal, 731219, India

^e Department of Physics, The University of Burdwan, Burdwan, West Bengal, 713104, India

^f Department of Physics, Hijli College, Kharagpur, 721306, West Bengal, India

^g Department of Mechanical Engineering, Jadavpur University, Jadavpur, Kolkata, 700032, India

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ABSTRACT

Several quaternary nanocomposites, doped with two transition metal oxides, of the generalised composition formula $0.4\text{ZnO}-0.1\text{P}_2\text{O}_5-0.5[\text{xV}_2\text{O}_5-(1-\text{x})\text{MoO}_3]$ were prepared via the melt quenching process. We investigated the microstructural and conductivity properties of two ternary systems and four quaternary systems to determine the better semiconductor nanocomposite system for wider application purposes. The X-ray diffraction results showed the presence of superposed nanocrystallites within amorphous networks or matrices. Analysis of ultraviolet–visible absorption spectra showed that optical bandgap energy (E_{opt}) values varied with V_2O_5 concentration, and there was an inverse relationship between E_{opt} and average nanocrystallite size. The responsible mechanisms of ac conductivity were examined using the model of Jonscher's universal power-law and Almond–West formalism, and it was found that ac conductivity increased as temperature rose, exhibiting semiconducting features. All the ternary (two examples) and quaternary (four examples) nanocomposite systems established non-linearity in dc conductivity, caused by the small polaron hopping process with dissimilar activation energies at different temperature regions. The power-law exponent (s) of Jonscher's universal power-law revealed that the ac conductivity mechanism could be described by correlated barrier-hopping (CBH) or non-overlapping small polaron tunnelling (NSPT) models for different samples due to major structural alterations. We applied modified CBH and NSPT models (as $s > 0.8$) to get realistic values of different fitting parameters, and in this process, we also obtained the values of ideal or hypothetical glass transition temperature from the theoretical models. The different activation energies associated with ac conductivity and for the small polaron migration process diminished with an increment in conductivity. Scaled ac conductivity spectra demonstrated that the conductivity relaxation process relied upon the composite structural features and did not depend on temperature. These materials can be used for such applications as gas sensors, even at higher temperatures due to their semiconducting nature and the different valence states of transition metal ions.

1. Introduction

Molybdenum trioxide (MoO_3), a transition metal oxide (TMO), normally does not function as a glass-forming oxide, but transforms the

glass structure by incorporating MoO_4 tetrahedral or MoO_6 octahedral structural units with some other glass-forming oxides, like phosphorus pentoxide (P_2O_5) and vanadium pentoxide (V_2O_5). Quite a few ternary glassy systems with the combination of P_2O_5 and MoO_3 have been

* Corresponding author.

E-mail address: anindyasundardas03@gmail.com (A.S. Das).

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Energy Efficient Route Discovery (EERD) for Time-Constrained Communication in Mobile Ad Hoc Network

¹Subhankar Ghosh; ²Anuradha Banerjee

¹ Regent Education and Research Foundation
Computer Science and Engineering Department
Barrackpore, West Bengal - 700121, India

² Kalyani Govt. Engg. College
Computer Application Department
Kalyani, West Bengal - 741235, India

Abstract - A mobile ad hoc network is an infrastructure less network, where nodes are free to move independently in any direction. The nodes have limited battery power; hence we require energy-efficient route discovery techniques to enhance node lifetime and network performance. In this paper, we propose an energy efficient route discovery (EERD) scheme that greatly reduces the number of route-requests flooded in the network by controlling their time-to-live attribute. This, in turn, improves the data packet delivery ratio of the underlying routing protocol and reduces the delay in discovering a suitable route to the destination. Also the average node lifetime increases because of reduced message cost.

Keywords - *Ad hoc network, Energy-efficiency, Selective flooding, Time constrained communication, Time-to-live.*

1. Introduction

An ad hoc network is a group of wireless mobile devices or nodes that communicate with each other in a collaborative way over multi-hop wireless links without any stationary infrastructure or centralized management. These networks are deployed mainly in battlefields and disaster situations such as earthquake, floods etc. Many routing protocols have been proposed for ad hoc networks. They can be mainly categorized as proactive and reactive routing protocols. Among proactive routing protocols, destination-sequenced distance vector (DSDV) [1], wireless routing protocol (WRP) [2], global state routing (GSR) [3] and cluster-based gateway switch routing (CGSR) [4] are well known. In all proactive routing protocols the nodes proactively store route information to every other node in the network. In general, the proactive routing protocols suffer from extremely huge storage overhead because they store information both about active and non-active routes. This inculcates the unnecessary complexity of discovering routes to the destinations with which a node rarely communicates. Reactive or on-demand routing protocols are designed to reduce this overhead. In reactive routing protocols, when a source node needs to communicate with a destination, it floods route-request packets throughout the network to discover a suitable route to the destination.

Dynamic source routing (DSR) [5], ad hoc on-demand distance vector routing (AODV) [6,7], adaptive communication aware routing (ACR) [8], flow-oriented routing protocol (FORP) [9, 10] and associativity-based routing (ABR) [11, 12, 13] are well-known among the reactive routing protocols. AODV builds routes using a route-request, route-reply query cycle. When a source node desires to send packets to a destination for which it does not already have a route, it broadcasts a route-request (RREQ) packet across the network. Nodes receiving this packet update their information for the source node and set up pointers backward to the source node in their routing tables. A node receiving the route-request (RREQ) packet sends a route-reply (RREP) if it is either the destination or has a recently established route to the destination with. Dynamic source routing (DSR) is similar to AODV in that it forms a route on-demand when a source node requests one. It uses source routing instead of relying on the routing table at each device. Determining source routes require accumulating the address of each router in the route-request message. Overall it may be noted that for all reactive routing protocols, flooding of RREQ packets inculcates high message cost in the network and if their lifetime can be reduced then a router receiving a RREQ with zero lifetime can discard the packet, instead of



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TECHNICAL PAPER



An ultra robust session key based image cryptography

Hari Narayan Khan¹ · Ayan Chaudhuri² · Abhishek Das³ · Atal Chaudhuri⁴

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Abstract

Increased use of internet demands substantial protection for secret image file from any adversary, specifically during transmission. In the field of cryptography there are two role models: cryptographer and crypt-analyst/attacker. The cryptographer develops techniques to make sure certain safety and security for transmissions while the crypt-analyst attempts to undo the former's work by cracking the same. The basic goal of our scheme is to design an image encryption model which is extra challenging against any attack. In our research article, we have introduced session key dependent image encryption technique wherein the session key is the function of an original secret key (known for a pair of sender and receiver one time forever at the beginning) and the present secret image to be encrypted. Additionally the scheme does not require extracting and remembering of session keys to construct the subsequent session keys although the keys change during each transmission. Besides, in our scheme a double encryption technique is required, which once again confirms that the technique we propose is more robust than the conventional image encryption techniques known till date and is capable of resisting cyber-attacks of such kinds.

1 Introduction

Nowadays, secret images are transferred over internet for political, medical, military, social, and for several important commercial purposes. Therefore, the main goals for image encryption are data confidentiality, data integrity, authentication, and non-repudiation. Each communicator needs to ensure that the real beneficiary should receive the image without any eavesdropping and intervention from any third party for every communication.

The existing cryptographic protocols can be broadly classified into two categories: symmetric (or private) key cryptography and asymmetric (or public) key cryptography (Taneja et al. 2011; Chhotaray et al. 2013; Kak 2015; Wang et al. 2017). In symmetric key cryptography, same

key is used for encryption and decryption. That secret key is only known to a fixed pair of sender and receiver. Hence symmetric key cryptosystem requires a secured exchange of secret key prior to transmission. On the other hand in asymmetric key cryptosystem the key used for encryption and the key used for decryption are different. The main idea behind such a system is that though it is computationally possible to generate a pair of public and private key but it is substantially difficult for an adversary to extract the private key from the public key.

Sreelaja et al. (2012) suggested an algorithm where authors have optimized the number of keys to be stored and distributed. Earlier Barker and Roginsky (2011) introduced key management techniques for alterations to the use of cryptographic keys. However there was no mention about the concept of secret variant session keys. Chakrabarti et al. (2008) provided the concept of time variant key which is an automatic variable key on optimum path choice in assured distributed models. The authors further discussed how the key could be applied and mentioned the possible application of automatic variable key. Besides Goswami et al. (2013) proposed automatic variable key based on time variant key where better randomness amongst the successive two keys is discussed.

Here, we present a novel concept of an image cryptography using time-variant symmetric key. In existing symmetric cryptosystems, if a hacker hacks the key at any time

✉ Abhishek Das
adas@aliah.ac.in

¹ Department of Computer Science and Engineering, Regent Education and Research Foundation, Kolkata, India
² Department of Computer Science and Engineering, Techno India, Kolkata, India
³ Department of Computer Science and Engineering, Aliah University, Kolkata, India
⁴ Department of Computer Science and Engineering, Jadavpur University, Kolkata, India



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ECONOMIC EMISSION DISPATCH OF THERMAL-WIND-SOLAR POWER SYSTEM BY USING NSGA II

S. K. Dey^a, D.P. Dash^b, M. Basu^a^aDepartment of Power Engineering, Jadavpur University, Kolkata^bDepartment of Electrical Engineering, Government College of Engineering, Kalahandi*Corresponding Author Email: michaelnichols3912@gmail.com

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ABSTRACT

Economic environmental dispatch (EED) of a thermal-wind-solar system in the company of battery is a significant chore in electric power plant operation that involves allocation of generation among the online units so that the price, NO_x extraction level and SO₂ extraction level are enhanced concurrently whilst gratifying each and every experimental constraint. In the current research, Nondominated Sorting Genetic Algorithm-II (NSGA-II) has been suggested for solving EED problem. The experimental outcomes obtained from the proposed method for EED have been fit to that gained from Strength Pareto Evolutionary Algorithm II (SPEA II).

KEYWORDS

Wind power uncertainty, PV unit, battery backup unit, fuel price, NO_x emanation intensity, SO₂ discharge intensity.

1. INTRODUCTION

Most electrical energy is produced by burning fossil fuels nowadays which releases various pollutants like oxides of sulfur (SO₂), Nitrogen oxides (NO_x), oxides of carbon (CO, CO₂) etc into the air. One of the principles defies for electric utilities is to decrease air contamination. The act proposed in the year 1990 related to Clean Air is planned to diminish global warming. It necessitates that the conventional generation units ought to the above mentioned pollutants spread dimension (Le et al., 1995).

More than one method has been projected in the writing to cut down the pollution of natural contamination (Talaq et al., 1994). This considers the installation of switching device that maintains the emission level, utilization of low emanation raw materials, and replacement of the old combustion chamber through new models and get away with outflow thought (Nanda et al., 1988; Farag et al., 1995).

These preliminary methods either call for the setting up of latest equipments or alteration of the existing equipments that involves significant funds disbursement. Therefore, the last method is more recommended. Diverse techniques have been discussed related to the Economic Emission Dispatch (EED) problem (Dhillon et al.; Chang et al., 1995; Yokoyama et al., 1988).

The three aims - price, NO_x extraction and SO₂ extraction are contradictory in nature and for discovering overall optimal dispatch they have to be considered concurrently. For arranging the on line generator productivity having the expected load requirement for getting most effective result in terms of price, NO_x extraction and SO₂ extraction at the same time while

satisfying each and every operational constraint the Economic environmental dispatch (EED) has been used.

Several methods related to EED problem are discussed in the text. The EED as a multiple, contradictory intentional issue & used goal-programming methods to resolve the non linear problem (Srinivasan et al., 1994; Huang et al., 1997). Optimization procedure based upon linear programming are discussed in where the objectives are regarded one by one (Srinivasan and Tettamanzi, 1997; Das and Patvardhan, 1998).

Numerous investigations were done to assess the development of multi-objective evolutionary search strategies throughout the previous couple of years. Strength Pareto Evolutionary Algorithm (SPEA 2) (Abido, 2003), Non-Dominating Sorting Genetic Algorithm II (NSGA II) (Robert et al., 2004), Multi-Objective Evolutionary Algorithm (MOEA) etc., comprise evolving multi-purpose techniques which are pertained towards solving the EED issues (Abido, 2006).

A non-dominated sorting genetic algorithm-II is recommended in this paper for EED of thermal wind sun oriented power framework with battery backup where price, sulphur dioxide (SO₂) extraction and oxides of nitrogen (NO_x) extraction are contending objectives.

This problem is produced as a nonlinear restricted multi-objective optimization difficulty (Wang and Singh, 2007; Wang and Singh, 2008; Agrawal et al., 2008).

Extensive experiments have been carried out for validating the proposed scheme by pertaining it on Test System. The results reported from the investigation on NSGA-II is compared and analyzed to that obtained from SPEA 2.

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Multi-Region Combined Heat and Power Economic Emission Dispatch



Suman Kumar Dey, Deba Prasad Dash, Mousumi Basu

Abstract: Multi-Region Combined Heat and Power Economic Emission Dispatch (MRCHPEED) is an important chore in operational and planning problem. The valve point impact and restricted useful zone of regular thermal generators have been contemplated. In this work, Nondominated Sorting Genetic Algorithm-II (NSGA-II) is proposed for illuminating confounded MRCHPEED problem where power and heat generations have been distributed amongst the all committed units so that fuel cost and outflow echelon have been streamlined in chorus though gratifying every single operational requirement. The research consequence of a two-region investigation framework achieved from the prescribed technique are coordinated up to those acquired from Strength Pareto Evolutionary Algorithm 2 (SPEA 2).

Index Terms- banished useful region; co-generation units; Multi-region; tie line imperatives; valve point effect.

I. INTRODUCTION

Economic dispatch (ED) allocates the generation level of all devoted turbines in a most price- effective way whilst gratifying numerous constraints in a solo structure.

In preferred, generating units are separated among several power production areas connected by using interconnections. Multi-Region Economic Dispatch (MRED) is a growth of lone place economic dispatch. MRED reveals the electricity creation stage along with communication of energy among areas for reducing cost of all sections while satisfying miscellaneous constraint. Different strategies [1]-[8] are converse to explain MRED issue.

Vestige fuel is transformed into electricity in unproductive style. The best part of electricity production desecrated during the technique of change is high temperature. Creating power from a particular fuel source, for example, flammable gas, biomass, coal progress the use of flow due to the difference in temperature along with usefulness of the renovation method is accelerated. In contrast with different variety of energy transmitter, the usefulness of energy of cogeneration is extra which creates less significant pollution. The Combined Heat and Power Economic Dispatch (CHPED) method implies power and heat creation accordingly that production billing is minimized along with satisfying miscellaneous constraint. Different proposal have already been proposed to solve CHPED issues and those are mentioned in reference section.

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* Correspondence Author

Suman Kumar Dey, pursuing his Ph.D. in Electrical Engineering Department of Power Engineering, Jadavpur University, Kolkata.

Deba Prasad Dash, working as Associate Professor, Department of Electrical Engineering, Government College of Engineering, Kalahandi.

Mousumi Basu, professor Department of Power Engineering Jadavpur University, Kolkata

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Huge incorporated power system is generally comprised of divergent locales dependent on an assortment of model for instance topographical, functional, forecast and administration.

Every one of these areas has been correlated to its connecting section along with interconnections. Each locale has its capacity and heat creation and energy and heat requirement.

Limiting the complete cost for every spot through stacking of every dedicated generating units along with co-generation and heat-only units in this way that true power equilibrium limit, heat stability imperatives, production boundary requirements, heat production limit requirements with interconnection limit requirements have been fulfilled while from a particular fuel source, for example, flammable gas, biomass, coal are going in the course of limited heat vs. true power plane is the main point of Multi-Region Combined Heat and Power Economic Dispatch (MRCHPED) .

Electric power plants based on fossil-fuel release a variety of pollutants which creates air pollution in the ambiance. Declining ambiance greenhouse gasses is another challenge for different power producers. The 1990 Clean Air Act is proposed for reducing atmospheric pollution. So today's civilization wants adequate and safe electricity at the cost-effective as well as minimum echelon of greenhouse gasses.

Various methods are proposed to decrease ambiance greenhouse gasses [9]-[15]. Among these tactics, dispatching taking into emission consideration is preferable.

The proposed approach is an expansion of Multi-Region Combined Heat and Power Economic Dispatch (MRCHPED) trouble. It plans a wide range of committed coal-fired generating units outputs, co-generation unit outputs, heat-only unit outputs and interchange power amongst regions with forecasted active power demand and heat request with the end goal that all out cost and outflow echelon in all sections are streamlined simultaneously satisfying an assortment of requirements.

This paper suggests NSGA-II to solve complicated multi-region combined heat and power economic emission dispatch (MRCHPEED) issues. For the given system, each region comprises coal-fired generating parts, co-generation parts and heat only parts. Every locale of the framework includes generation entity, co-generation entity and heat only entity.

To triumph over intricacy of binary version for trading with unremitting explore break with big proportions, Real-Coded Genetic Algorithm (RCGA) [16] is exploited. The Simulated Binary Crossover (SBX) and polynomial mutation are used here.

Economic Environmental Dispatch of Wind Integrated Thermal Power System



Suman Kumar Dey, Deba Prasad Dash, Mousumi Basu

Abstract: In electric power plant operation, Economic Environmental Dispatch (EED) of a thermal-wind is a significant chore to involve allocation of production amongst the running units so the price, NO_x extraction status and SO₂ extraction status are enhanced concurrently whilst gratifying each and every experimental constraint. This is an exceedingly controlled multi-objective optimizing issue concerning contradictory objectives having Primary and Secondary constraints. For the given work, a Non-dominated Sorting Genetic Algorithm-II (NSGA-II) is recommended for taking care of EED issue. In simulation results that are obtained by applying the two test systems on the proposed scheme have been evaluated against Strength Pareto Evolutionary Algorithm 2 (SPEA 2).

Keywords: Economic environmental dispatch, wind power uncertainty, fuel charge, NO_x discharge intensity, SO₂ discharge intensity, NSGA-II.

I. INTRODUCTION

Most electrical energy is produced by burning fossil fuels nowadays which releases various pollutants like oxides of sulfur (SO₂), Nitrogen oxides (NO_x), oxides of carbon (CO, CO₂) etc into the air. One of the principles defies for electric utilities is to decrease air contamination. The act proposed in the year 1990 related to Clean Air is planned to diminish global warming. It necessitates that the conventional generation units ought to the above mentioned pollutants spread dimension [1].

More than one method has been projected in the writing to cut down the pollution of natural. This considers the installation of switching device that maintains the discharge level, utilization of low emanation raw materials, and replacement of the old combustion chamber through new models and get away with outflow thought[2]. These preliminary methods either call for the setting up of latest equipments or alteration of the existing equipments that involves significant funds disbursement. Therefore, the last method is more recommended. Diverse techniques [3]-[9] have been discussed related to the Economic Emission Dispatch (EED) problem. However, these techniques cannot handle the non-linear fuel charge and discharge level functions.

The three aims- price, NO_x extraction and SO₂ extraction are contradictory in nature and for discovering overall optimal dispatch they have to be considered concurrently[10]-[12]. For arranging the on line generator productivity having the expected load requirement for getting most effective result in terms of price, NO_x extraction and SO₂ extraction at the same time while

satisfying each and every operational constraint the Economic environmental dispatch (EED) has been used.

Several methods related to EED problem are discussed in the text. Nanda et al. took up EED as a multiple, contradictory intentional issue & used goal-programming methods to resolve that [13]. Optimization procedure based upon linear programming are discussed in [14] where the objectives are regarded one by one. In the previous ten years, the EED issue was changed into an issue with single target through linear combining of differing points as a weighted entirety [15]-[16]. It necessitates through changing weights to acquire a bunch of non-subservient answer. Regrettably, in case of problems with non-convex Pareto-optimal front it is of no use. For circumventing such problem, the ϵ -constraint technique is discussed in [17]. It makes the most use of the most favorable aim and regards the other aims as constraints leaped through a number of acceptable levels. However, the stochastic search algorithms are very faster; accurate for example probabilistic technique for approximating the global optimum of a given.

Numerous investigations were done to assess the development of multi-objective evolutionary search strategies throughout the previous couple of years [18]-[20]. It is found that in all these approaches, the extraction function is formulated as a mixture of either sulphur dioxide (SO₂) and oxides of nitrogen (NO_x) or only nitrogen oxides (NO_x). However, in this paper sulphur dioxide (SO₂) and nitrogen oxides (NO_x) extraction objectives are regarded as separate functions.

In reduction of the effect of Global Warming, wind power and solar PV plants are becoming popular along with fulfilling power stipulate at reasonable price having no dangerous extractions. But intermittent wind and solar power require schemes and dispatch strategies for upholding economy with dependability and safety measures.

A non-dominated sorting genetic algorithm-II is recommended in this paper for economic environmental dispatch of thermal wind sun oriented power framework with battery vitality stockpile framework where price, sulphur dioxide (SO₂) extraction and oxides of nitrogen (NO_x) extraction are contending ideas. Here difficulty arrived as a nonlinear restricted multi-objective optimization [21].

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* Correspondence Author

Suman Kumar Dey*, Ph.D. in Electrical Engineering under the Department of Power Engineering, Jadavpur University, Kolkata.

Deba Prasad Dash, Associate Professor, Department of Electrical Engineering, Government College of Engineering, Kalahandi.

Mousumi Basu, Professor at Power Engineering Department of Jadavpur University.

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