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Swarnali Sharma

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Contents

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Sustainable Sequestration Of Carbon Dioxide – A Review

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Abstract

Among various GHG gases causing global warming, the contribution by CO_2 alone is about 60%. Post combustion carbon capture is most viable technique compared to pre-combustion and oxy-fuel combustion CO_2 capture techniques used for conventional coal based thermal power plants. Cryogenic separation, chemical absorption, adsorption, membrane based separation etc. belong to post combustion carbon sequestration technology however these methods have some or other disadvantages. Ocean injection results in lowering of pH of sea water thus affecting bacteria zooplankton and benthos species. Moreover following a considerable period of time, the stored CO_2 can leak. Controlled addition of CO_2 in ready-mix concrete, as produced in the United States, Canada and Singapore improves the compressive strength without sacrificing performance or durability. Microalgae consumes substantial quantity of carbon dioxide (1 Kg dry algae biomass consumes about 1.83 Kg CO_2) and hence very effective in bio-fixation of CO_2 waste as well as in improvement of air quality. Accumulation of oil (about 20 to 50% weight of dry biomass) and fast growth of microalgae make microalgae cultivation a commercially interesting and promising technology to mitigate global warming problem and generation of bio-fuel alongwith other benefits namely production of nutrient dense foods, chemicals and fertilizer.

Keywords: Greenhouse gases; ready-mix concrete, sustainable; microalgae; biomass; bio-fixation

Introduction

Still now, thermal power plants mostly are fulfilling the rising energy demand and thus constitute major cause of CO_2 emission. Rapid industrialization including installation and commissioning of various chemical manufacturing plants, urbanization, deforestation and increased automobile exhaust emission constitute increasing release of carbon dioxide. Due to these human activities,CO_2 concentration in atmosphere has risen upto 380 ppm from 280 ppm (parts per million) with a span of last50 years [1]. Due to this, various detrimental effects such as rise in sea level, melting of floating iceberg, and global warming warn the subsistence and growth of humankind. Hence it is utmost important to design suitable methodologies to efficiently collect CO_2 and transform into industrially suitable materials.

From the flue gas CO_2 is to be removed and then it is required to be stored for subsequent use and thus the negative impacts of carbon dioxide release could be reversed. The concept of circular carbon economy (CCE) deals with various technologies associated to capture carbon at emission site and store for subsequent use for manufacture of fire extinguishers, plastic components, fuels, fertilizers, soda ash, food and drinks, building materials etc.[2]. The paper has been undertaken to discuss different latest methods required to be adapted for controlling and solving the critical issue of

A Trust-based Framework for the Detection and Avoidance of Blackhole Nodes in Opportunistic Networks

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Abstract: An Opportunistic Network (OppNet), as opposed to a ubiquitous centralized network, relies on sporadic and opportunistic encounters between nodes to facilitate communication. The uncertainty about the node's nature presents challenges when nodes with malicious intents are present in the network. One category of malicious nodes includes blackhole nodes, which receive messages but drop them intentionally. In this paper, we introduce a novel trust function designed to detect blackhole nodes within the network. Our function has been widely tested and simulated to validate and increase the efficacy of transmission of messages in the network. We have performed a comparative analysis with various protocols (PROPHET, Epidemic and Spray And Wait) on several parameters such as Delivery Ratio, Overhead Ratio and Number of Messages dropped. The results demonstrate that our trust function is able to correctly detect and avoid blackhole nodes. We observed significant improvement in delivery ratio in Epidemic Routing (47%), Prophet (41%), and Spray And Wait Routing (17%) protocols when adjusting blackhole nodes while keeping the total network nodes constant.

I. INTRODUCTION

The TCP/IP network system is widely used for its ability to provide a stable and reliable connection between source and destination, as well as its fast transmission time. In recent days, wireless network structure has come into existence due to its flexibility and adaptability. Kevin Fall proposed the Delay Tolerant Network in 2003. Opportunistic Network (OppNet) is one branch of DTN(Delay Tolerant Network). OppNets[1-2] is a combination of MANET (Mobile AdHoc Networks)[3] and DTN(Delay Tolerant Network)[4]. In an OppNet, a constant framework is not present and it includes mobile nodes, such as humans in a social DTN. The nodes experience infrequent connection, intermittent communication, and a network topology that constantly changes. In OppNet, routing adopts a store-carry-and-forward[5] approach due to the absence of end-to-end connectivity. This approach enables message transmission through multiple intermediate nodes by leveraging opportunistic encounters, which, in turn, leads to increased end-to-end latency.

As the nodes in an OppNet are built into a non-centralised network system, it does not need a backbone like a TCP/IP Network. The store-carry-forward mechanism yields many advantages, as follows

1. Nodes can be installed in handheld devices, cars, etc, reducing the need for an expensive backbone network.

2. It primarily focuses on successful delivery of messages tolerating the delay,

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Evolutionary Algorithm Inspired Binary Sequence based Fault Detection in Uniformly Excited Linear Antenna Array

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***Abstract*—This Present article proposes a hybrid technique of fault finding in uniformly excited linear antenna array with improved execution time. In this technique differential evolution algorithm has been used to approximate the faulty behavior of uniformly excited linear antenna array. After anticipating the approximate behavior, binary sequence based method has been developed facilitating identification of faulty elements in the linear antenna array. Effectiveness of the method has been demonstrated through fault instances in 26 elements uniformly excited linear antenna array of isotropic radiators.**

Keywords— Evolutionary Algorithm, Binary Sequence, Fault Detection, Uniformly excited linear antenna array

I. INTRODUCTION

This Antenna array has been one of the indispensible components of wireless communication system. Performance degradation of antenna array adversely affects the communication systems in general. Such degradation happens due to fault in antenna array wherein one or more than one elements becomes non responsive in nature resulting in distorted radiation pattern. As such detection of faulty elements is necessary facilitating pattern restoration. In this regard a lot of research has been reported in open literatures with the objective of fast and efficient detection method for antenna arrays [1-24].

Lee et. al. have experimentally shown that near field probing data for 8×8 dipole array can be used to find the faults in the array [1]. However accuracy of the method has been found to be moderate. To overcome such limitations Bucci et. al considered a far field power pattern based method where in on-off type of faults have been considered [2]. The method uses a modified genetic algorithm to find the optimum amplitude distribution for planar array from which faulty elements can be identified at the expense of modest computational effort. To reduce the computational effort Patnaik et. al. have used artificial neural network (ANN) to find faults in 5 elements binomial array and 16 elements microstrip array in [3] and [4] respectively . It has been observed that use of ANN improves the computational effort at the expense of large training time resulting in another modest method of fault finding. In continuation to the efforts reported in [3-4], Vakula et. al have worked on understanding the type of fault in linear antenna array using neural networks [5]. Further to reduce the computational cost Iglesias et. al. have developed a case based reasoning system for fault diagnosis in moderate and large linear antenna arrays at the expense of moderate detection accuracy [6]. Acharya et. al. have considered fault detection method in linear antenna array as an optimization problem [7]. In this method bacteria foraging (BF) technique has been used to find the optimum excitation amplitude corresponding to faulty far field radiation pattern. Khan et. al. have shown the application of firefly algorithm (FF) in identifying fault in non uniformly excited linear antenna array [8]. A comparative study of fault finding in antenna array using neural network and genetic algorithm has been reported in [9]. From the comparative study it has been observed that both the methods are computationally intensive. In [10],Harrou et. al. have proposed exponentially weighted moving average-based control scheme to detect one element full fault, two element partial fault and degradation caused by noise in linear antenna array. Muralidharan et. al. have develop fast fourier transform (FFT) based method for detecting the position and the level of fault in antenna arrays, from the degraded far field pattern samples [11]. A modified version of the method using iterative fast fourier transform (IFFT) has been reported in [12]. Puri et. al. have shown the application of particle swarm optimization (PSO) in detecting defective element in space borne planar array [13]. Harrou et. al. have proposed a statistical fault detection method based on the generalized likelihood ratio (GLR) principle for detecting potential faults in linear antenna arrays [14-15]. Chen et. al. have proposed

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Effect of Stochastic Randomness in Natural Frequency Increment of a Trapezoidal Laminated Composite Plate

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Abstract **-** This paper highlights the considerable stochastic effects while taking a deterministic approach to satisfy a dynamic objective function involving the free vibration behavior of a laminated composite trapezoidal plate. The study considers relevant material and geometric parameters of the plate under investigation as stochastic without changing the plan area of the plate which generally happens in many industrial and engineering applications. Investigation of the stochastic effects of material properties, ply thickness, and ply orientation on the objective of reaching an increased natural frequency is carried out by Monte Carlo simulation. Abaqus CAE is used to calculate the increment in the thickness required for the desired rise in the natural frequency of a symmetrically laminated plate. It is shown that variation in reaching the desired frequency increases with the increase of the coefficient of variation of the input variables. A positive linear trend between the coefficients of variation of the desired frequency and input variables is found, whose slope increases as randomness is considered for a greater number of input variables. Probability of failure in reaching the desired frequency is shown to be heavily dependent on the combined variation of material and geometry. In particular, the probability of failure in reaching a desired frequency shows an undulating trend for both types of variation considered. In general, it is also shown that randomness in geometry has a more pronounced effect compared to that in material only.

Keywords**:** Non-rectangular trapezoidal plate, Dynamic properties, Increment in natural frequency, Material and geometric randomness, Stochastic effects

1. Introduction

Laminated composite materials are widely applied in many industries for their high strength-to-weight ratios and flexibility in design. Their ubiquity, especially in aerospace and aeronautical engineering, such as aircrafts, UAVs, helicopters, missiles, space stations including their use in fabricating civil engineering cladding units requires designers to have a thorough understanding of their mechanical behaviour. However, due to the uncertainty introduced in determining the strength and stiffness properties of laminates during the manufacturing of the individual composite layers and the laminated structure as a whole, a purely deterministic study can potentially be non-conservative and insufficient. Hence all such material and geometric properties shall be treated as random variables and their uncertainty should be quantified either experimentally or computationally.

Experimental data on the mechanical properties of unidirectional glass/polyester showed a coefficient of variation (CV) ranging between 10% to 20% for elastic and shear moduli as well as the material strengths, with variation as high as 24.90% [1]. In unidirectional carbon fibre-reinforced polymers (CFRP), experimental data showed variation as high as 13.1% for tensile strengths [2], with less variation in other material properties. Recent research [3] has shown that, while the elastic properties of carbon fibre/epoxy composites possess a CV of around 5%, the CV of the mechanical strength still ranges from 10% to 20% [4,5]. Uncertainties in material properties lead to uncertainties in dynamic behaviour [6].

Natural frequency enhancement to avoid resonance due to machine installation is often required within a restricted plan area. The geometric and material properties always have elements of uncertainty as a natural occurrence due to the inevitable fabrication inaccuracies in layup and curing. In such cases, even a slight shift in the characteristics of any of the plate