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Non Linear Analysis And Optimization Of Flywheel

Dinesh Patil, Prof. Gayatri S.Patil

[1]*PG Student, Mechanical Engineering Department, KJCOE & MR , SPPU, Pune.*
[2]*Professor, Mechanical Engineering Department, KJCOE & MR , SPPU, Pune.*
Maharashtra, India

Abstract - *Flywheels serve as kinetic energy storage and retrieval devices with the ability to deliver high output power at high rotational speeds as being one of the emerging storage energy technologies is available today in various stages of development feild, especially in advanced technological areas. Many causes are there of flywheel failure among them and one of is the non-linear behavior of the flywheel. Hence this work evaluation is done of non-linear stresses in the flywheel for different material . The solid work software used fordesign of flywheel. The ANSYS software is used for analysis and apply forces for validation of flywheel is. The FEA of flywheel is considering centrifugal forces on its comparative non-linear analysis von-mises stress is done, shear stress and deformation of the flywheel made of Cast iron and aluminum alloy. The paper gives too topology optimization approach in the mass of flywheel reducing.*

1. INTRODUCTION

1.1 Flywheel Detail

The word 'flywheel' appeared first during the start of industrial revolution. There were two important developments during this period, one is the use of flywheels in steam engine and other is widespread use of iron. Iron material has high integrity that flywheels made up of wood, stone or clay.
Flywheel is a device (mechanical) which is used as a storage device for rotational energy due to its significantly high moment of inertia. Flywheels are required where there is a fluctuation in input power and output load is constant or there where is a fluctuation in output load and the input power remains constant Flywheel is like as a reservoir to store energy when supply is more than requirement and to release the energy when requirement is more than supply. Flywheel provides an effective way to smooth out the fluctuation of speed.

1.2 Problem Statement

The flywheel is dynamic part hence the non-linear static analysis does not gives the exact value of stresses developed in flywheel. It is difficult to find out such type of stresses with the help of numerical analysis to overcome these problems. Modern technologies are used such as FEA software. The paper deals with the study of stresses induced in a flywheel made of different material by using non-linear analysis.

1.3 Objectives

1. To study the stress induced in Subaru EJ25D gasoline engine flywheel..
2. FEM Modeling of Flywheel
3. Perform Non-Linear Analysis using ANSYS.
4. Consideration of flywheel model for shape optimization.
5. Experimental Validation.

1.4 Scope

Considering the overall importance of Flywheel as an energy storage device, we focus on nonlinear analysis by using step loading apply & shape optimization of flywheel. Hence the main concentration will be:

1. To use FEA/FEM as method and software to find the stresses in the flywheel.
2. Optimize the flywheel for reduction in cost & high fuel efficiency.
3. Perform non linear analysis to find the best suitable material for flywheel manufacturing.
4. And most important is dynamometer test perform on flywheel, etc.

2. COMPUTER ADDED MODELLING & FEA

2.1 Introduction to Solid works

Solid works is based on a single database, parametric, and modular process-oriented PLM system. Today all over the world as businesses, small, SMEs and large industrial companies from all sectors to all types of design processes and product development,
production machinery, moulds, household appliances, automotive, agricultural machinery ,shipbuilding, electrical / electronics, medical products, telecommunications, household appliances, metal products, heating and cooling and the manufacturing sectors such as defence and aerospace design and product development processes of all types of co lateral industries, universities , institutes of technical education institutions and R&D is the software used. This is the result of the different sectors to respond to the modular structure.

A Comparative of Steel Silo Subjected To Specified Ground Motion

Sanket Manohar Khilare[1], Dr. S .K. Patil [2]
Department of Civil Engineering
[1]PG student , K. J. College of Engineering and Management Reseach,Pisoli
[2]K. J. College of Engineering and management Reseach,Pisoli

Abstract-*Silos are containers used for storing bulk solids. Although there is no generally accepted definition for these terms, shallow structures containing coal, coke, ore, crushed stone, gravel, and similar materials. Silos are special structures subjected to many different unconventional loading conditions, which result in unusual failure modes. In this present study pressure calculation is carried out by STAAD-Pro and Janseen's theory for dynamic condition and additional pressure due seismic action is calculated by Theoretical approach. Base shear force generated at bottom of silo is compared with IS 9178 Part-2 and seismic conditions using IS 1893-2002. Calculation is completely based on respective codal provision applied to Indian seismic zones, site condition etc.*

Keywords*-*SSilo, silo failure, action of forces, seismic behavior, Staad-Pro

I. INTRODUCTION

1.1 General

Silo, bins, or bunker are container used for storing bulk solids. Although no specific definition for all these terms, shallow structure use for storing coke, coal, crushed stone, gravel, ore & other similar material is usually called bunkers & bins. Tall structures use for storing grains, cement is often called silos. Most of industries used silos to store bulk solids, quantity ranges from a thousand tones to hundred to few tones. Power station, cement plant, gas work in many shorter and big establishments where storage of bulk material is necessary, for the purpose of storing material silo is used.

Silo structure may be elevated or rest on ground have circular, square or rectangular in shape. Rectangular or Square silos usually have single outlet with pyramidal bottom, but sometimes a trough bottom is used with a single elongated outlet or two or more circular or square outlet. Silo which is in circular shape have flat bottom or conical bottom with single outlet. Material used for construction of silo may be steel & reinforced concrete.

Governing factor in design of silos are the type of material stored in it and their properties. Bulk material density, frictional properties & pattern of material flow varies generously, the applied loads and load caring system different in structure like silo than other traditional structure. Silos are designed as special structure & also design is based on the strength design method.

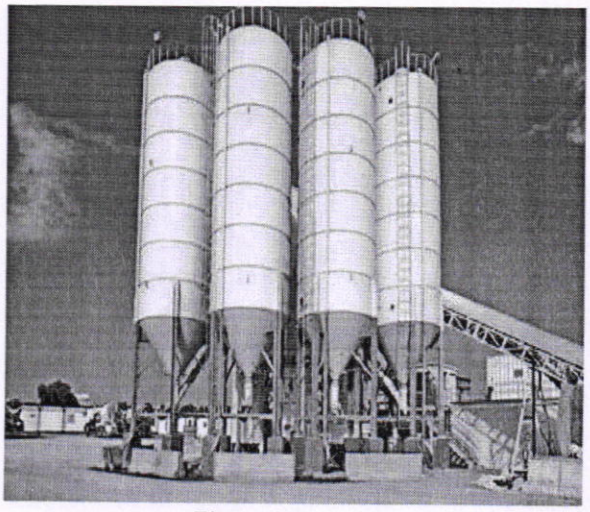

Fig.no-1(steel silo)

Collapse of silo in seismic failure is the major failure; occur because of improper assumptions, wrong analysis and design. In this study consider circular flat bottom silo symmetrical about vertical axis & RCC slab provided at the top and bottom of silo by proving small open able hole to top of silo for filling storage material in it. In this study compare various method of silo design and seismic force calculation by using different codal provision like IS. The walls of the silos are typically subjected to both normal pressure and vertical frictional shear or traction produced by the material stored inside the silo. The magnitude and distribution of both shear and normal pressure over the height of the wall depend on the properties of the stored material. Calculation of seismic load consider silo self-weight and material stored in it as a lumped mass and seismic effect of this mass is considered in design of the silo wall.

A Study of Fragility Analysis of Transmission Tower Subjected To Specified Ground Motion

Anant R Patil[1], Prof. S. K. Patil[2]
Department of Civil Engineering
[1] Student,K J College of engineering & management Research
[2] Head ,K J College of engineering & management Research

Abstract-*In this paper, the fragility analysis and concept of critical collapse curve for transmission tower sub-jected to wind and rain loads are presented to ac-quire the collapse equivalent basic wind speed and most unfavorable combinations of wind and rain loads corresponding to collapse status. The calcu-lating method for wind and rain loads is simplified and the error analysis is performed to validate its effectiveness. The concept of equivalent basic wind speed is used to conduct the fragility analysis of transmission tower subjected to wind and rain loads which avoid the complex formula of rain load and the choice of different combinations of basic wind speed and rain intensity, and then the concept of critical collapse curve is proposed to evaluate the collapse status of transmission tower. At last the influence of wind attack angle and wind spectrum on the fragility and critical collapse curves is discussed, and results show that the wind attack angle and wind spectrum have a great influ-ence on fragility and critical collapse curves. In this study, it can be seen that the use of equivalent basic wind speed make it possible to conduct the fragility analysis under wind and rain loads and the pro-posed concept of critical collapse curve is very con-venient to evaluate the collapse status for struc-tures subjected to wind and rain loads. In addition, the rain load has a great contribution to the tower collapse and should be paid more attention during severe gales and thunderstorms.*

Keywords*-*Steel Tower, Staad-pro

I. INTRODUCTION

1.1 Introduction

The seismic risk analysis includes three contents: seismic hazard analysis, fragility analysis and earthquake-induced loss estimation. Among them, the fragility analysis is to study the probability of structural failure for a given ground motion level, and can predict probabilities of the occurrence of different damage states induced by different magnitudes of earthquakes. The seismic capacity of transmission tower is evaluated by using nonlinear buckling analysis method and nonlinear dynamic analysis, considering the inherent uncertainty of the structure and ground motion. And the performance limits of different damage states induced by earthquake are determined. The objective of this literature is to evaluate the fragility curve of transmission towers based on seismic performance analysis considering the inelastic structural behaviour and the uncertainties.

The seismic capacity of transmission tower is evaluated by using nonlinear buckling analysis method and nonlinear dynamic analysis, considering the inherent uncertainty of the structure and ground motion. And the performance limits of different damage states induced by earthquake are determined. The objective of this literature is to evaluate the fragility curve of transmission towers based on seismic performance analysis considering the inelastic structural behaviour and the uncertainties.

In order to determine the fragility curve of the transmission tower, it's necessary to determine seismic responses of the tower induced by different magnitude of earthquakes. Due to the randomness of the ground motion, the seismic performance of the building will respond with uncertainty as well. The randomness of the ground motion is realized by building a package of various ground motions covering a wide range of peak intensity, time-varying amplitude, strong-motion duration and frequency content.

The inelastic behaviour of the transmission towers subjected to the extreme earthquakes has been investigated extensively. The towers might collapse or be damaged when shaken by intensive earthquakes. However, the information relating the nonlinear inelastic responses of such towers under extreme seismic loading with the damage severity is lacking, and the damage state of the tower remains unclear. Therefore, one of the objectives is to define the damage states of such structures under earthquake loading based on the performance analysis.

1.2 Aim

To perform seismic fragility analysis of transmission tower in seismic zone 4 and 5.

1.2.1 Objectives

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COMPARITIVE ANALYSIS AND DESIGN FOR PRECAST AND RCC EWS BUILDINGS

Mohini V. Patel
M.E Structures, Civil Department,
KJ College of Engineering & Management Research
Kondhwa Saswad Road, Near Bopdeo Ghat, Pune 411048.

A.B.Pujari
Assistant Professor
KJ College of Engineering & Management Research
Kondhwa Saswad Road, Near Bopdeo Ghat, Pune 411048.

ABSTRACT

This paper investigates that how the precast technology will be helpful for the country like India where the more population is present. For this situation providing the shelter to all economical weaker section people the precast technology will be helpful. To Indian government to provide the shelter to all people and with optimum cost of construction the precast will be preferable. With the help of etabs software we analyzed the both rcc and precast structure for structural stability and have checked for all the different conditions and which gave the satisfactory results for the structures.

Key words: Precast, RCC, EWS, ETABS, Linaer Static and Dynamic Analysis.

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1. INTRODUCTION

The face of realty market in India has changed rapidly over the past few years. The large projects comprising of Townships Mass Housings, IT/ITES parks and SEZs' are of common occurrence these days and will only grow exponentially in the near future. Majority of such projects are still being constructed using the conventional methods. Thus the inherent advantage that these projects offer in terms of repetitions and huge volume turnover remain unexploited. In addition, these large scale projects constructed using conventional methods complicates the Project Management in terms of speed and quality of the construction.

India is a growing economy. It is estimated to be the third largest economy by 2050 [13] and also India's urban population registered a decadal growth of 32 percent, rising from 285

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Distributed Control System Using Wired Communication Channel

Pramod U. Chavan[1]*, Ramadevi. R[2], M. Murugan[3], Sheela Rani. B[4]

[1]Department of Electronics and Communication Engineering, Sathyabama University, Chennai, Tamil Nadu, India

[2]Department of Electronics and Instrumentation Engineering, Sathyabama University, Chennai, Tamil Nadu, India

[3]Department of Electronics and Communication Engineering, SRM's Vallammai College of Engineering, Chennai, Tamil Nadu, India

[4]Director (Research), Sathyabama University, Chennai, Tamil Nadu, India

Abstract

This paper addresses the important aspects of RS-485 as a wired system for successful data transmission design. Wired distributed control system offers flexibility in the design and implementation at low cost and such can be applied in many useful situations. While designing distributed control system, the difficulties arises both in basic safety correctness properties as well as in achieving high performance. Hence the main objective of this research is to provide brief information about RS-485 which defines the electrical characteristics of drivers and receivers that could be used to implement a balanced multipoint transmission line. This work focuses on the distributed control system in which RS-485 is used for point to point communication and providing a choice of drivers, receivers depending on the cable length, number of nodes and also to conserve power. The advantage of the proposed system is that it can handle the growing amount of work or complexity of the network. This model consists of a master and multiple slaves to control and monitor different sensors and actuators of the system. Communication between master and slaves is established using RS-485 bus. For easiness, comfort and safety a GUI using visual basic is implemented.

Keywords: *Distributed control System, RS-485, wired communication, master and slave*

****Author for Correspondence*** E-mail: pramodp.chavan@gmail.com; rama_adarsh@rediffmail.com

INTRODUCTION

Application areas for wired network controlled systems have been growing from last decade at a very rapid rate. The distributed control systems usually consist of master and several slaves connected to each other through communication link such as TCP/IP, RS-232, CAN and RS-485 [1]. RS-485 is a flexible standard for automation systems. It is a standard communication protocol for connecting computer and its peripheral devices to allow serial data exchange. The master unit controls the flow of communication process and in contrast the slave is just receiving any incoming commands from the master. Thus several slaves are realized by certain communication protocol. Field bus is an industrial network that is specifically designed for the communication between various controllers and the field mounted sensors and actuators to the controller I/O. Remote I/O stations can also be used with the field bus wiring. Field bus has main advantages over conventional point to point wiring such as significant reduction in installation cost (typically 20-40%), system expansion, and simple modification, less expensive for the reason that only the additional cable run from the offered network to the new device must be installed. As the communication is digital, accuracy is not affected by the noise, interference or electrical loading effect etc.

Wired communications are well thought of to be the most stable and reliable of all types of communication services. They are relatively impervious to unfriendly weather conditions when compared to wireless solutions [2–4]. With some form of wired services, the strength and speed of the transmission is superior to

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Low Power RF Transceiver using Piezoelectric Vibration Energy Harvesting Technique for Wireless Sensor Node

Sanjay S.Khonde[1], Dr.Ashok Ghatol[2] and Dr.Sanjay .V.Dudul[3]

[1]Associate Professor & Head, Department of Electronics& Telecommunication, Genba Sopanrao Moze College of Engineering, 25/1/3, Balewadi, Haveli, Pune, Maharashtra 411045, India.
[1] Orcid Id: 0000-0002-2064-372X
[2]Director, Genba Sopanrao Moze College of Engineering, 25/1/3, Balewadi, Haveli, Pune, Maharashtra 411045 India.
[3]Professor & Head, Department of Applied Electronics, Sant Gadge Baba Amravati University, Camp Area, Near Tapovan Gate, Amravati, Maharashtra 444602, India.

Abstract

In a wireless sensor network the sensor nodes are placed at remote location and they operate on batteries .The major issue in wireless sensor network is the power consumption of the sensor node. Even though the sensor nodes operate on batteries, the batteries are to be changed after specific time interval. The battery replacement is not a viable solution as it is costly and time consuming .So some alternative method for battery replacement is to be used .The ambient energy can be used to power up the sensor node. The technique of converting ambient energy into electrical energy is called energy harvesting .In this paper the piezoelectric vibration energy is used as energy harvesting technique. The technique generates electrical energy which is used in place of batteries for wireless sensor node. The hardware of the system consists of RF transceiver CC2500, microcontroller MSP 430, piezoelectric crystal and other components. Batteries are not required for the system. The system is maintenance free and coves a distance upto 300 ft. The current consumption is from few microampere to 20 mA from wakeup to transmission.

Keywords*:* RF Transceiver; Energy harvesting; piezo electric effect.

INTRODUCTION

Energy harvesting is a technique used to convert the ambient energy present in the environment into electrical energy. This technique has the capability to act as an independent power supply for wireless microsystems, as an alternative to use batteries. The wireless sensor nodes are using batteries and operates at extremely economical energy budget. Since battery replacement is not a viable solution, these low power wireless sensor nodes need an alternative type of power source instead of traditional batteries. Renewable power can be obtained by generating electrical energy from the environment. Thus extracting power from the ambient sources is called energy harvesting or energy scavenging [4]. The available energy sources for harvesting are light, wind, motion, RF electromagnetic radiations .In this paper a nonlinear vibration energy harvester is used to power a low power wireless RF transceiver device. This RF transceiver is powering itself or self-powered and no batteries are required. It is able to transmit the data at few meters distance such as temperature and operated in 2.4 GHz ISM band. The rest of the paper includes details of vibrational energy harvester, the hardware part of the system and the system evaluation.

ENERGY HARVESTING

As a part of energy harvesting the solar and wind energy have been widely used to provide electrical energy during the last decade. The power consumption of sensor node has been significantly reduced due to recent advancement in low power electronics. Hence ambient harvesting energy may provide a long term solution and reduce the dependency on batteries [2]. The fig 1. shows energy harvesting as alternative for micro powering. The figure consists of energy harvesting generator, temporary storage system and an electronic device which is being charged up. The energy harvester generator can be piezoelectric, electrodynamic, photovoltaic or thermostatic. The temporary storage system can be ultra-capacitor or rechargeable batteries. This stored power is then given to any electronic device like low power devices, wireless sensors, MEMS actuators or any consumer electronic device.

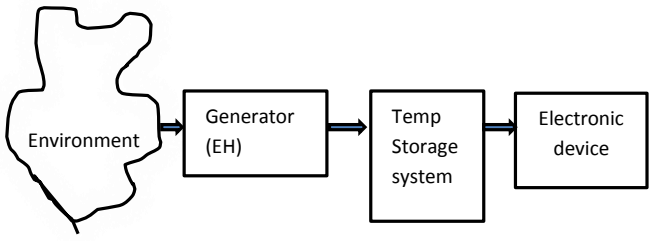

Figure 1: Energy harvesting as alternative for micro powering

Energy harvesting from vibrations and movement has recently become promising for powering sensor nodes .Kinetic energy in the form of small scale vibrations is a common form of

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Design of Digital Circuit for Low Power Communication Centric RF Transceiver in Wireless Sensor Node using VHDL

[1] Sanjay S.Khonde; [2] Dr.Ashok A. Ghatol; [3] Dr.Sanjay V.Dudul

[1] Research Scholar,Sant Gadge Baba Amravati University , Amravati, Maharashtra, 444602 , India

[2] Former-Vice-chancellor of BATU, Lonere, Maharashtra, 444602,India

[3] Professor &Head, Department of Electronics, Sant Gadge Baba Amravati University, Amravati Maharashtra, 444602 , India

Abstract- In wireless technology machines are talking with machines. The sensors have batteries as power backup. There is a serious issue of maintenance of these batteries and exchange of batteries, so there is a need of such a wireless sensor node which will consume very less power without affecting the functionality like speed, range and standard compliance. The power breakdown of wireless sensor node shows that the hungriest part is RF transceiver chip. So total power consumed by the sensor node can be reduced by reducing the power consumed by RF transceiver. The common solution is to activate the transceiver by changing the duty cycle. The duty cycle change is not correct solution because it has some drawbacks. So the possible solution to solve the issue is designing a digital control circuit which will activate the main radio after listening to channel and generating a interrupt as and when required. This on demand communication mechanism will reduce power wastage. The architecture of sensor node is to be modified to communication centric approach rather than traditional approach. The digital control circuit will wake up the transceiver as and when correct message will arrive at the input. The data packet is to be defined for the same. The digital circuit is using 2.4 GHz operating frequency. The power supply used is 1.8 V – 2.1 V. The circuit consists of analog front end comprising of LNA which amplifies the signal, a detector which detects the signal and decoder which retrieves the original signal from packet that arrives. Once the signal is decoded it goes to digital control block which is the main block of the circuit. The implementation is carried out in VHDL and program is run in Xilinx 14.7 software .A test bench is written in Verilog for simulation purpose. The simulation is carried in Isim software available in Xilinx 14.7 .The simulation of the code shows that the time required to write and read the data parameters is 16.4 uSec. Accordingly the performance analysis is carried out. First power consumption of CC2500 RF transceiver without digital control circuit is calculated. In active mode it comes out to be 20 uWatt. Then when the digital control circuit is present the power consumption of same RF transceiver is calculated, it comes out to be 0.034 pWatt. This shows that with the help of digital control circuit the power consumption is very less as compared to without digital circuit. The rest of the paper consists of System overview, experimental results, performance analysis and conclusion

Keywords: *RF, Wireless Sensor Node, Power Consumption, VHDL, Simulation*

1. Introduction

Wireless technology is nowadays very popular field. Machines are talking with machines. The wireless sensor and control use batteries as a power backup. The exchange and maintenance of batteries is serious issue. There is a need of such a wireless sensor node which will consume very less power. The power backup problem can be solved using energy harvesting [1] or energy scavenging. The main challenge to develop low power sensor network node is management of energy consumption without affecting the functionality like speed, range and standard compliance. Energy management deals with process of managing energy resources by means of controlling the battery discharge, adjusting the transmission power, and scheduling the power resources so as to increase the lifetime of the node. The energy efficiency of a sensor node is defined as amount of data delivered by node to the total energy expended. Higher the efficiency greater the number of packets delivered by node with given amount of energy reserve. To address the power consumption problem the common solution is to activate the transceiver periodically with the help of duty cycle. Due to variation in the application nature, communication latency and energy requirement the duty cycle requirement changes. The duty cycle strategy gives improvement in power consumption.[3] The node has to listen to communication channel for data (idle listening), or has to carry out over listening. Another drawback of duty cycle scheme is delay caused by receiver for receiving the data. The synchronization between transmitter and receiver is also technical challenge. So the possible solution to solve the issue is designing a digital circuit which will activate the main radio after listening to channel and generating a interrupt as and when required. This on demand communication mechanism will reduce power wastage. The traditional approach for low power radio sensor node architecture is processor centric. In this mode processor is main component which handles the transceiver. This requires additional power.

Self-Organized Hybrid Wireless Sensor Network for Finding Randomly Moving Target in Unknown Environment

Mininath Nighot*, Ashok Ghatol, Vilas Thakare

SGB Amravati University, Computer Department, 444602, Maharashtra (India)

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Abstract

Unknown target search, in an unknown environment, is a complex problem in Wireless Sensor Network (WSN). It does not have a linear solution when target's location and searching space is unknown. For the past few years, many researchers have invented novel techniques for finding a target using either Static Sensor Node (SSN) or Mobile Sensor Node (MSN) in WSN i.e. Hybrid WSN. But there is a lack of research to find a solution using hybrid WSN. In the current research, the problem has been addressed mostly using non-biological techniques. Due to its complexity and having a non-linear solution, Bio-inspired techniques are most suited to solve the problem.

This paper proposes a solution for searching of randomly moving target in unknown area using only Mobile sensor nodes and combination of both Static and Mobile sensor nodes. In proposed technique coverage area is determined and compared. To perform the work, novel algorithms like MSNs Movement Prediction Algorithm (MMPA), Leader Selection Algorithm (LSA), Leader's Movement Prediction Algorithm (LMPA) and follower algorithm are implemented. Simulation results validate the effectiveness of proposed work. Through the result, it is shown that proposed hybrid WSN approach with less number of sensor nodes (combination of Static and Mobile sensor nodes) finds target faster than only MSN approach.

Keywords

Particle Swarm Optimization, Self-Organization, Target Finding, Hybrid Wireless Sensor Network.

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1. Introduction

Wireless Sensor Networks have gained worldwide attention due to its potential applications in area surveillance such as disaster monitoring, animal monitoring, underwater monitoring etc. [1],[2]. Different sensors have their own physical properties like temperature, moisture, smoke, light, odor, etc. As per the demands of application specific sensors are recommended to be used. The main challenges in WSN are its low bandwidth, memory limitation, and processing power. Researchers need to consider these limitations of WSN to provide a solution. In recent work, very few researchers focused on hybrid WSN due to communication hurdle between SSN to MSN.

Numbers of computations are required in analytical optimization methods. The number of computations depends on the size of the problem. If problem size increases, then computations also increase exponentially. Bio-inspired optimization techniques can be another alternative to analytical optimization. It is more efficient for the increased problem size or when the problem is complex [3],[4],[5].

The objectives of the paper are a) to simulate random moving target searching in an unknown environment, with minimum sensor nodes in hybrid WSN (SSN and MSN), b) to efficiently use, PSO (Particle Swarm Optimization) technique to achieve group movements of MSNs for target searching c) to compare area coverage of all approaches.

* Corresponding author.
E-mail address: imaheshnighot@gmail.com

A. PSO - Particle Swarm Optimization

Self-organization is one of the important features of Swarm Intelligence (SI). Self-organization is a nonlinear distributed system which cannot have a linear solution and is not controlled by any single particle. It is a continuous process in which particles interact with each other locally [6], [7].

Initially,self-organized systems are predictable, but after some iteration or some time instances, these may be predictable, neutral or unpredictable.

There are mainly five features:

- Positive feedback
- Negative feedback
- Amplification
- Multiple iterations
- Balance of exploitation & exploration

The system has positive and negative feedback in which positive feedback inspires for the creation of convenient structure while negative feedback neutrals the positive feedback [8],[9],[10].

Multiple iterations are required to reach to the goal. All particles find their own best position (i.e. Local best position). Among the local best positions of all particles, a best position is chosen (i.e. global best position) and all particles use best global position for next movement.

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RESEARCH ARTICLE

WILEY

Distributed Energy Efficient Tracking in Hybrid wireless sensor network (DEETH)

Mininath Nighot | Ashok Ghatol | Vilas Thakare

Computer Department, SGB Amravati University, Amravati 444602Maharashtra, India

Correspondence
Mininath Nighot, Computer Department, SGB Amravati University, Amravati, 444602 Maharashtra, India.
Email: imaheshnighot@gmail.com

Summary

In wireless sensor network (WSN), it is a complex task to track the target when it is moving randomly in an unknown environment. It also becomes difficult to cover a complete searching area because of the limited searching range and energy of sensor nodes as they are few in number. The author proposes a distributed energy efficient tracking in a hybrid WSN (DEETH) to track a randomly moving target in an unknown searching. Hybrid WSN that is proposed has both static sensor nodes (SSNs) and mobile sensor nodes (MSNs), which are deployed in the searching area. The MSNs move collectively using particle swarm techniques to search a target. The SSNs are deployed for tracking the presence of a target and giving this information to the base station. As per the information given by SSN, MSNs travel to the target and track it. Simulation results prove that proposed technique successfully tracks the target using less number of nodes and also less amount of energy.

KEYWORDS

energy consumption, particle swarm optimization, RSS-based target tracking, sHybrid wireless sensor network

1 | INTRODUCTION

In the recent times, wireless sensor network (WSN) has gained momentum and is utilized for border surveillance, mine detection, animal tracking, etc for the purpose of detecting and tracking intruders, observing their behaviors, and controlling their illegal activities. In these applications, a randomly moving tracking target is a common complex problem.

A number of techniques are suggested in the literature to provide a solution, but still, there are a lot of challenges like the reliability of networks, communication protocol, usages of heterogeneous sensors in the network, distributed and collaborative data processing, sensor deployment to cover complete searching area, data aggregation, tracking accuracy, and energy consumption.[1]

Many authors have proposed their solutions by considering 1 or 2 challenges, but still, there is a need to provide a generic solution for area surveillance.[2,3] In the proposed system, Particle Swarm Optimization (PSO)–based mobile sensor node (MSN) navigation is implemented.[4,5] The objectives of the paper are (1) to simulate randomly moving target searching in an unknown environment, with minimum sensor nodes in hybrid WSN (static sensor node [SSN] and MSN), (2) to efficiently use, PSO technique to achieve group movements of MSNs for target searching, and (3) to compare energy of all approaches.