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**3.3.2: Number of Books and Chapters in edited volumes/books published and papers published in national/ international conference proceedings per teacher during 2020-21.**

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| 2 | M. V. Waghmare | NA | Effect of dam reservoir interaction on response of dam subjected to dynamic analysis | Recent Trends in Civil Engineering | International Conference on Recent trends and Innovations in Civil Engineering | 2020-21 | 2 |

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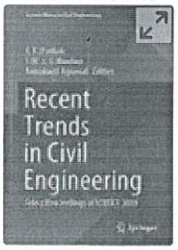


Recent Trends in Civil Engineering pp 197–209



# Manufacturing of an Economical Single Degree-of-Freedom Shake Table

Ketan N. Bajad & Manisha V. Waghmare

Conference paper | First Online: 28 September 2020



Part of the Lecture Notes in Civil Engineering book series (LNCE,volume 77)

## Abstract

Shake table is the most effective and well-organized device than any other test for understanding the basic concepts of earthquake. This paper provides a well-organized, effective, economical, and affordable single-DOF shake table. It gives a straightforward and user-friendly platform for engineering students to practically understand and carry out the scientific study of earthquakes. The study proceeds with the

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Recent Trends in Civil Engineering pp 945–961



# Effect of Dam Reservoir Interaction on Response of Dam Subjected to Dynamic Load

Pooja D. Girme & Manisha V. Waghmare

Conference paper | First Online: 28 September 2020

851 Accesses | 2 Citations

Part of the Lecture Notes in Civil Engineering book series (LNCE,volume 77)

## Abstract

Gravity dams are solid structures that maintain their stability against design loads due to their geometric shape, mass, and material strength. In access to the static water pressure, the dam undergoes dynamic forces from the reservoir when the system is subjected to earthquake ground motion. When the structure and the fluid are placed alongside and

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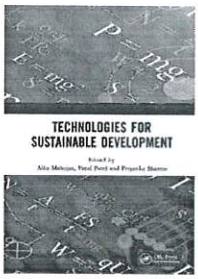


# Numerical analysis of shape-memory-alloy-wire based smart natural rubber bearing

*By Prachi M. Ujalambe (/search?contributorName=Prachi M. Ujalambe&contributorRole=author&redirectFromPDP=true&context=ubx), M.V. Waghmare (/search?contributorName=M.V. Waghmare&contributorRole=author&redirectFromPDP=true&context=ubx)*

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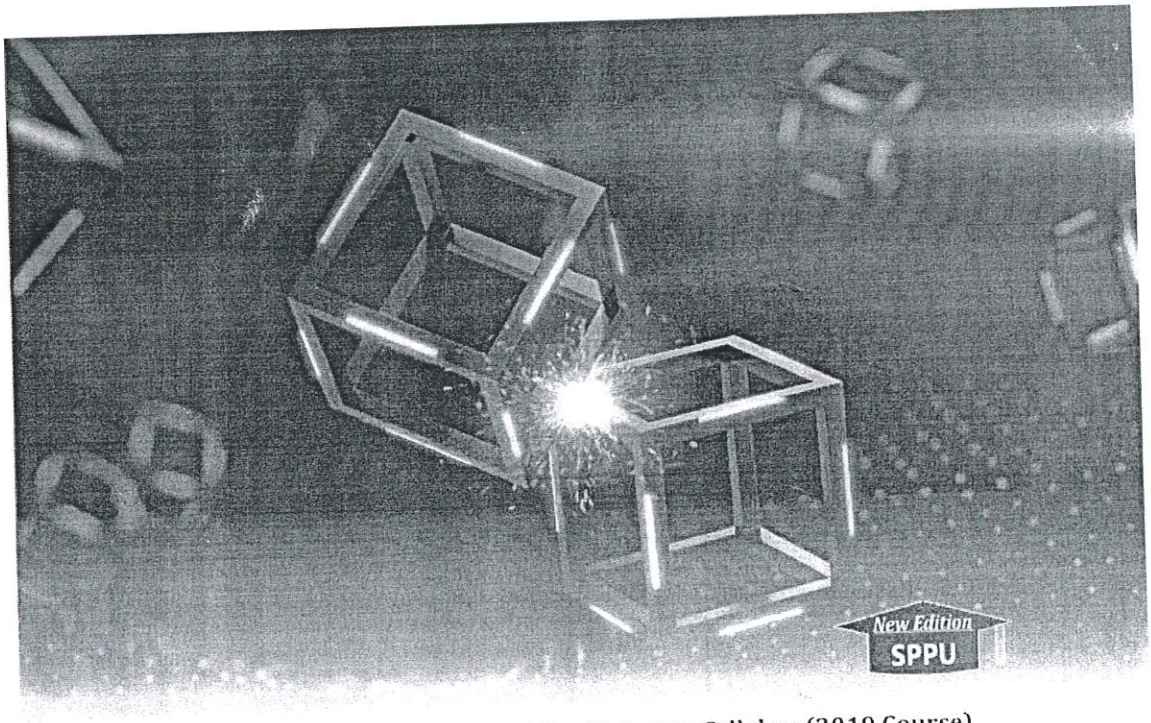


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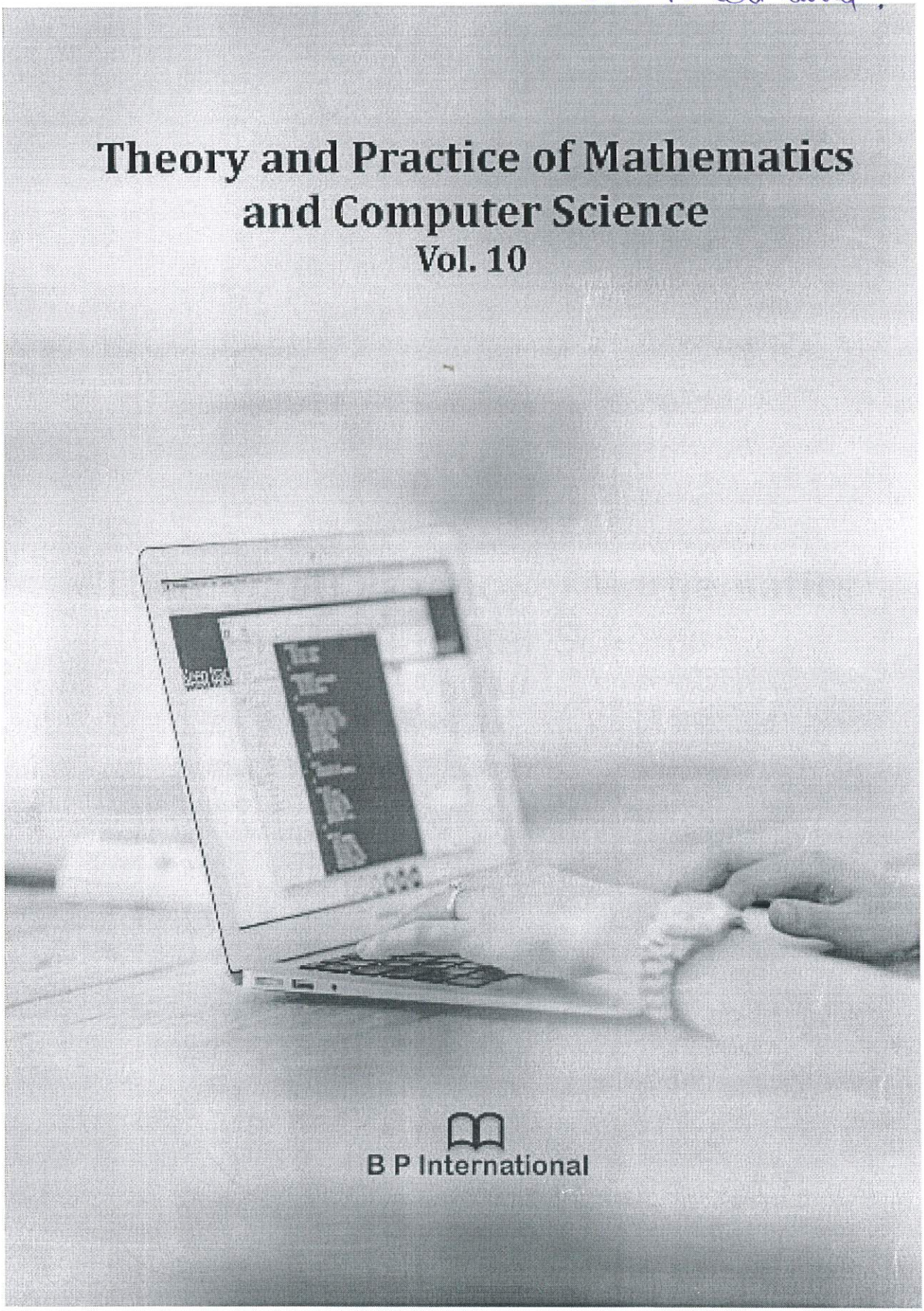


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**Rule Learner and Multithreading Technique with Genetic Algorithm for**

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# Inline Intrusion Detection System for High Speed Network

**D. P. Gaikwad**

*Theory and Practice of Mathematics and Computer Science Vol. 10*, 10 May 2021, Page 144-156

https://doi.org/10.9734/bpi/tpmcs/v10/1550E (https://doi.org/10.9734/bpi/tpmcs/v10/1550E)

**Published:** 2021-05-10



## Abstract

Intrusion detection system plays the important role in recognizing unauthorized user, abnormal packets and malicious code in network. Investigators have proposed many techniques and methods of intrusion detection system. The challenging task in intrusion detection system is to find out appropriate method which offers low false positive rate and high classification accuracy. Rule based classifiers or learners are based choice for intrusion detection system. These are advanced and simple to implement. The performance of rule based intrusion detection system is depending on the rules produced by rule learner. Rule formation process is slow and time consuming task due to huge amount of packets in networks. Ensemble of rule learners are being used for intrusion detection system which provides high accuracy.

In this chapter, a novel architecture of intrusion detection system using single rule learner has presented. The system has implemented by using rule learner with multi-threading technique. In this implementation, the Ripple Down Rule learner is used as a classifier and Genetic Algorithm as a feature selection method with Multithreading technique. The advantages of parallel processing feature of multi-threading help to handle the heavy traffic in high speed network. The cache management module of the system is used to reduce the memory access rate. The proposed intrusion detection system is evaluated in terms of classification accuracy and false positive rate. The performance evaluation results show that the proposed intrusion detection system outperforms existing standard classifier. The logging mechanism of proposed system is useful to reprocess and analyses logged packets in future for investigation and forensic purpose. It is also found that the time required to generate rules from the training data set is lower as compared to the model building time of existing rule based classifiers in intrusion detection system.

**Keywords:** Multi-threading; rule learner; cache updating; false positive; classification accuracy

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# Theory and Applications of Mathematical Science Vol. 1

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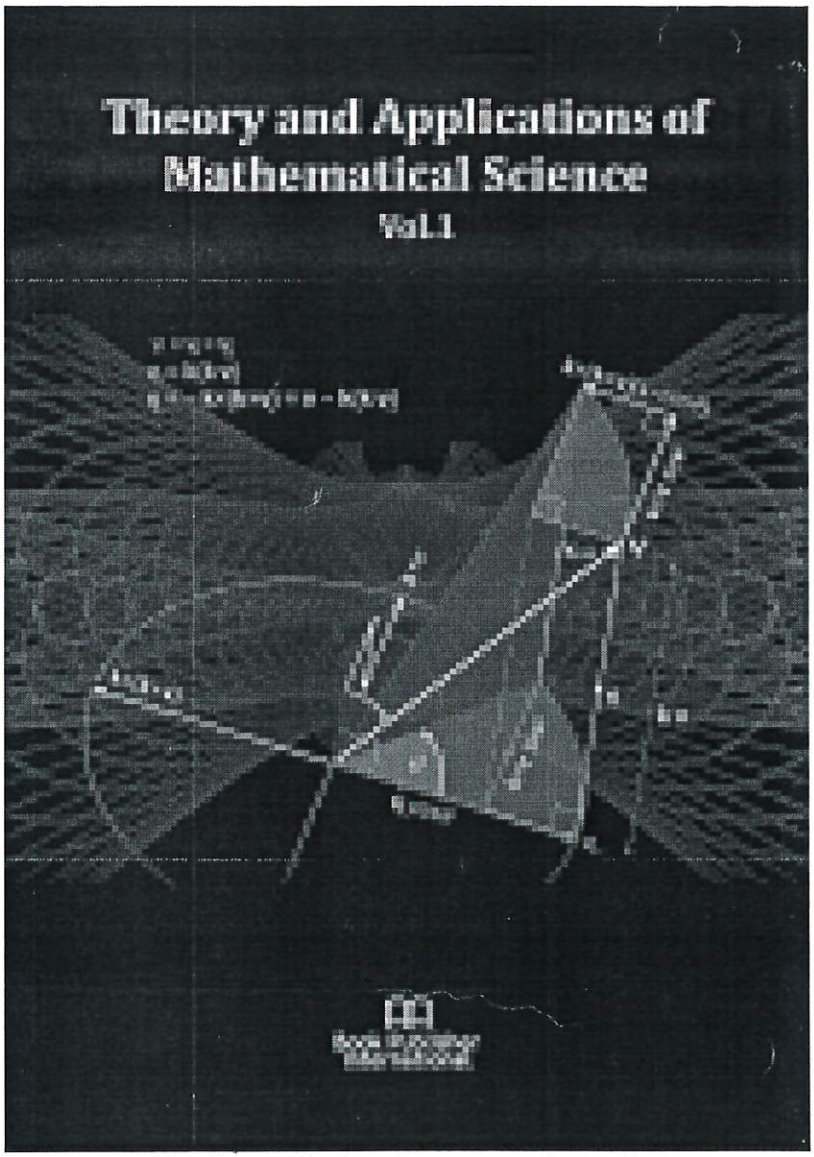


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# Ensemble of Soft Computing Techniques for Inline Intrusion Detection System

D. P. Gaikwad ; R. C. Thool

*Theory and Applications of Mathematical Science Vol. 1*, Page 79-95

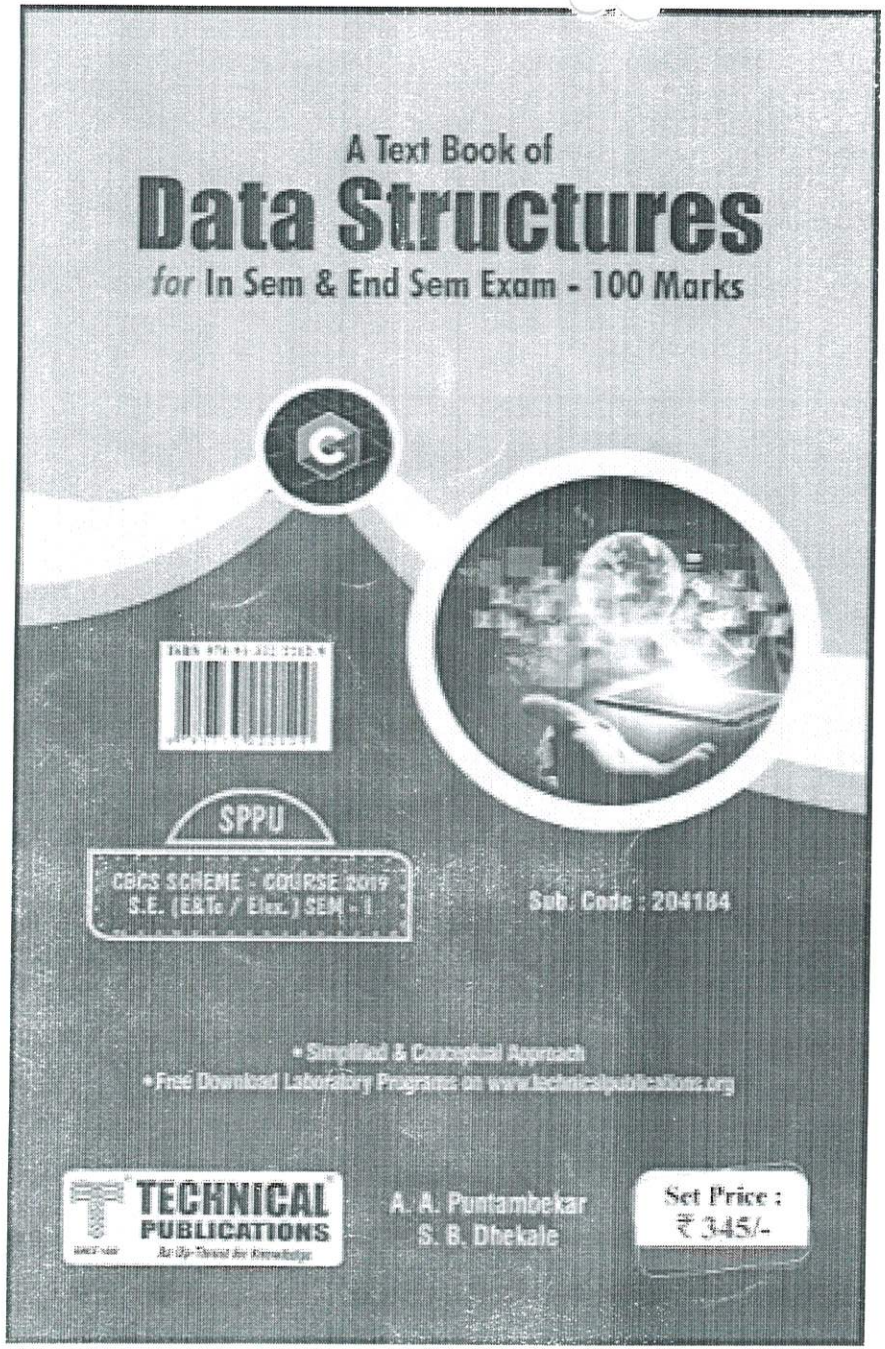
**Published:** 4 January 2020



## Abstract

An intrusion detection system automates the supervising activities in a computer network and computer system. It is used to analyses activities in network or computer. Basically, intrusion detection system is used to identify abuse or incomplete threats of abuse of computer security policies. It detects intruders, malicious actions, malicious code, and unwanted communications over the Internet. Despite the advancements and substantial research efforts, the general intrusion detection system gives high false positive rate, low classification accuracy and slow speed. For overcoming these limitations, many researchers are trying to design and implement intrusion detection systems that are easy to use and easy to install. There are many methods and techniques of intrusion detection system. Soft computing techniques are gradually being used for intrusion detection system. In this chapter, we present the ensemble approach of different soft computing techniques for designing and implementing inline intrusion detection system. In this work, three base classifiers are implemented using different artificial neural networks. Initially, Neuro-fuzzy neural network, Multilayer Perceptron and Radial Basis Function neural network have been constructed. These three networks have been combined using voting methods of machine learning. Three base classifiers are separately trained and evaluated in term of classification accuracy, false positive rate, false negative rate, sensitivity, specificity and precision. The voting combination ensemble method of machine learning has used to combine these three trained models. The performance ensemble classifier is evaluated and compared with the performances of base classifiers. In our study, we found that final ensemble classifier using Neuro-fuzzy, Multilayer Perceptron and Radial Basis Function neural network is superior to the individual base classifier in detection of intruder in network. The performance of ensemble classifier is measured in terms of classification accuracy and sensitivity. It is also found that ensemble based classifier for intrusion detection system has reasonable classification accuracy, the best sensitivity and false negative rate with very low false positive rate on test data set. The experimental results show that the base classifiers take very less time to build models and the proposed ensemble classifier for intrusion detection system takes very less time to test data set. These advantages can help to deploy the intrusion detection system to easily capture and detect online packets.

**Keywords:** Machine learning; intrusion detection; false positives; neuro-fuzzy; multilayer perceptron; ensemble; voting combination rule

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3.3.3

# Adaptive Diagonal Loading of MVDR Beamformer For Sustainable Performance In Noisy Conditions

Kirtimalini Chaudhari
*Department of E & TC Engg*
*AISSMS College of Engineering*
Pune, India
kirtibchaudhari@gmail.com

Mukul Sutaone
*Department of E & TC Engg*
*College of Engineering Pune*
Pune India
mssutaone.extc@coep.ac.in

Prashant Bartakke
*Department of E & TC Engg*
*College of Engineering, Pune*
Pune, India
ppb.extc@coep.ac.in

***Abstract*—The performance of Minimum Variance Distortionless Response (MVDR) beamformer can be improved by enhancing its ability to suppress interference and noise effectively. Generally, the number of microphones should be large in order to get greater interference suppression. However, this decreases the stability of a beamformer. To improve stability a diagonal loading factor is added in the noise covariance matrix. An increase in loading factor causes poor suppression and larger deviations in the values of the loading factor mislead the steering vector in another direction. As the exact noise covariance matrix is unknown, it is estimated from the interference and noise. In this paper, the issue of estimation error is addressed. The amount of diagonal loading is estimated adaptively by considering actual snapshots of the input signal. An additional constraint on the diagonal loading is proposed, which improves the robustness and stability of the MVDR beamformer. A tradeoff between the stability and diagonal loading factor is investigated. The effect of adaptive diagonal loading on output SINR and stability is analyzed.**

***Index Terms*—MVDR, beamformer, stability, invertibility, SINR, covariance estimation error, adaptive diagonal loading, Condition number, array signal processing, acoustic beamformer, estimation error, ADL, microphone arrays**

## I. Introduction

With the inventions of new smart devices, microphone arrays are becoming the most preferred choice for hands-free acquisition of signals from sound sources located at distinct locations. Depending upon the directional information, the array output is steered in a specific direction. The signal processing techniques used to achieve this are known as beamforming. Beamformers are widely used in applications such as radio telescopes [1] and wireless networking [2]. In acoustic signal processing, the beamformers are extensively used in hearing aid [3], automatic speech recognition [4], source separation and localization [5], robots [6], personal assistant [7], orchestral recording [8], and many more.

Many beamforming algorithms are proposed until now to achieve optimum performance of the beamformer [9], [10]. An exhaustive study of microphone arrays and beamforming with respect to speech enhancement and source separation is done by many [11]. Since its inception, Minimum Variance Distortionless Response (MVDR) has remained one of the most extensively explored beamformers in the class of data dependent beamformers [12]. It minimizes the output power of the beamformer by imposing a single linear constraint on the response of the beamformer. Many variants of MVDR are proposed till now [13]–[19] with the intention to enhance the interference suppression capability, spatial resolution, or the array gain of MVDR. In the era of machine learning, beamformers are also becoming more robust and accurate [20], [21].

The performance of the MVDR beamformer degrades drastically with inaccuracies in the estimation of steering vector or covariance matrix. Lots of efforts have been done to address the issue of estimation inaccuracies. The overview of the work done in the field may be obtained from the review article [22]. To achieve robustness against inaccuracies in the estimation, method of adding diagonal loading factor and adjusting its value adaptively to compensate the estimation mismatches are proposed [23], [24].

In this paper, we address the effect of adaptive diagonal loading on the interference suppression capability of MVDR in a noisy environment. We investigate the stability of the beamformer and the relationship between the number of microphones in the linear array and the diagonal loading factor to achieve the desired signal to interference plus noise ratio (SINR).

The paper is organized as follows: MVDR beamformer is presented in section II. MVDR beamformer with adaptive diagonal loading is proposed in section III. Experimental results are presented in section IV followed by the conclusion in section V.

## II. Minimum Variance Distortionless Response Beamformer

Let $M$ number of equidistant microphones be placed in a straight line to form a uniform linear array. A source signal $s(t)$ located far from an array reaches microphones with an incident angle $\theta$. If the first microphone is the reference microphone, the subsequent microphones will receive the source signal with some time delay $t_m$. This delay is reflected as a phase difference in the frequency domain. At the microphone, the target signal $s_d(t)$ is mixed with interfering

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# Indian Sign Language Recognition

Shilpa Bhople[1], Prof. R. R. Itkarkar[2], Pooja Bhoir[3]
[1]ME Scholar (Digital System), E&Tc Engg. Dept., JSPM's Rajarshi Shau COE, Pune, India
[2]Professor, E&Tc Engg. Dept., JSPM's Rajarshi Shau COE, Pune, India
[3] ME Scholar (VLSI &Embedded System), E&Tc Engg. Dept., JSPM's Rajarshi Shau COE, Pune, India
[1]shilpabhople10@gmail.com, [2]itkarkarrajashri@yahoo.com, [3]pooja.p.bhoir@gmail.com

***Abstract:*** *Hand gesture is one of the typical methods used in sign language for non-verbal communication. It is most commonly used by people who have hearing or speech problems to communicate among themselves or with normal people. Various sign language systems have been developed by manufacturers around the globe but they are neither flexible nor cost-effective for the end users. Different methods used for the feature extraction like HMM, SVM, Neural Network and PCA. The system is mainly implemented by using image pre-processing, segmentation, feature extraction and gesture recognition. PCA is used for feature extraction. Using PCA method we can reduce original variables into a lower number of orthogonal. Principal component analysis (PCA) is a statistical technique for reducing the dimensionality of a data set in which there are many interrelated variables, while retaining as much of the variation in the dataset as possible. The data set is reduced by transforming the old data to a new set of variables (principal components) that are ordered so that the first few variables contain most of the variation present in the original variables. The original data set is transformed by computing the eigenvectors and eigen values of the data set's covariance matrix.*

***Keywords:*** *HCI, Segmentation, Feature Extraction, Indian Sign Language, PCA.*

## I. INTRODUCTION

Hand gesture recognition has been a very active research topic in recent years with an application such as human computer interaction (HCI), Robot control & sign language interpretation. In order to find a solution to the problem of communication with deaf and dump people the sign language is useful. Computers have become a key element of our society e.g. surfing a web, typing a letter, playing video game or storing & retrieving data. Computers will increasingly influence our everyday life because of the constant decrease in the price of computers. Thus, HCI has become an active field of research in the past few years. Gesture recognition and gesture based interaction have received increasing attention as an area of HCI [1].Vision based method is potential and low cost. So it is very attractive sensing modality for developing hand gesture recognition. The goal of gesture recognition is to create a system which can identify specific human gestures use to convey the information.

Gesture: Gesture may be defined as a physical movement of the hands, arms, face and body to convey information or meaning. Basically two methods are used for human computer interaction they are:

1. Data Gloves: In this method user used gloves with sensor attached to it like mechanical or optical. This transfer finger into electrical signal for determininghand pos tures. In this case user approach forces to carry load of cables which are connected to the computer.
2. Vision based: Computer vision based it is technique based on the way of human beings perceive information about their surroundings. It is field that includes methods for acquiring processing analyzing and understanding images and high dimension data from real world in order to produce numerical or symbolical information i.e. in the form of decisions [2].

Gesture recognition different color space used for skin color detection. Skin color plays very important role in image processing. Primary step is chose color space for skin color classification. RGB is default color space for most available. Image formation from RGB to any color space obtained using linear or non-linear transformation to decrease the overlap between skin and non-skin pixels. Skin colors differ more in intensity than chrominance so, commonly the luminance component used for skin classification. The YCbCr space represents color as luminance (Y) as a weighted sum of RGB values and chrominance component Cb & Cr computed by subtracting the luminance component from B & R values. The YCbCr is one of the most popular choices for skin detection [3].

*Gesture Using PCA*

1. PCA: Principal component analysis (PCA) is a statistical procedure that uses an orthogonal transformation convert a set of observations of possibly correlated variables into a set of values of linearly uncorrelated variables called principal components.
2. Using PCA method we can reduce original variables into a lower number of orthogonal (non-correlated).

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# Advances in Mechanical Engineering

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# A Study on Performance and Emission Characteristics of Diesel Engine for Lower Blends of Karanja Biodiesel

V. R. Patil, S. S. Sane, and S. S. Thipse

**Abstract** Increased number of vehicles are causing higher consumption of petroleum fuels leading to depletion of conventional fuel reserves. Hence, there is a need for alternative fuel, which will fulfil the demand. Biodiesel is one of the environment-friendly, renewable alternative biofuel which can be obtained from vegetable oils. Blends of various biofuels were used by researchers but there are limitations on the percentage of vegetable oil in diesel as emission norms are becoming stringent. Recently, the Government of India has announced that country is going to implement BS VI emission norms by 2020 and higher blends, i.e. B20 and above B20 are not satisfying these norms. Presently, very limited information is available on the use of lower biodiesel blend as a fuel in diesel engines. In this work, efforts are made to study the effect of lower blends of Karanja biodiesel as a fuel in a diesel engine to evaluate its performance and emission characteristics. The engine performance test was conducted on single cylinder four stroke diesel engine with lower blends of Karanja biodiesel (B5, B7, B10), B20 and diesel fuel to find brake thermal efficiency and BSFC. HC, CO, $CO_2$ and $NO_x$ emissions also have been monitored. Results showed the brake thermal efficiency of all lower blends (B5, B7, B10) is high compared to diesel fuel at full load of the engine. BSFC of all lower blends (B5, B7, B10) is low at part load and almost the same as that of diesel fuel for maximum load. HC and CO emissions were less compared to diesel fuel. Also, a significant reduction of $NO_x$ was observed for B5, B7, B10.

**Keywords** Biodiesel · Higher blends · Lower blends · Diesel engine · Emission

V. R. Patil (✉)
Department of Mechanical Engineering, AISSMS College of Engineering, Pune, India
e-mail: vrpatil@aissmscoe.com

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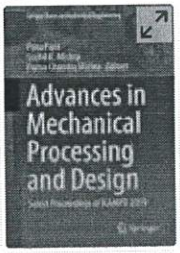


**Advances in Mechanical Processing and Design** pp 389–397



# Tribo-Behaviour of Tin-Based Dry Bearing Material

Priya S. Gajjal

Conference paper | First Online: 26 November 2020



Part of the Lecture Notes in Mechanical Engineering book series (LNME)

## Abstract

Bronze is used widely as a journal-bearing material for copper-based alloys. These materials are good for high electrical and thermal conductivity, good corrosion, self-lubrication, and wear resistance for a long period of time and give good results for use as journal bearings. In this study, wear and friction properties of journal bearings manufactured with different percentage of tin 6%, 8%, and 10% bronze and the effect of PV (pressure × velocity) parameter have been investigated and examined. Experiments

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Priya Gajjal
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# Tribo-Behaviour of Dry Sintered Material



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# Tribo-Behaviour of Dry Sintered Material

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The book aims at characterizing friction and wear behaviour of sintered bearings in tribological point of view as well as their geometrical and thermal aspect considering the tribo-behaviour of a system. Each chapter dwells extensively and exhaustively on a particular design with hypothetical data analyzed and interpretations to aid the readers understanding of the design. This is thus a must read book for all involved in designing of experiments in diverse field. Frictional characteristics of sintered bearing having plain as well as additives added were studied considering process, constructional and manufacturing parameters to render it suitable lubricant in sliding contact conditions. An empirical relationship between coefficient of friction and parameters were investigated. Wear characteristics of dry sintered bearing with and without additives under different tribological conditions using dry bearing test rig were investigated. An empirical relationship between coefficient of friction and parameters were established. Using dimensional analysis technique a mathematical model considering lump parameters was developed.

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Advances in Manufacturing Systems pp 181–192



# Use of Sustainable Practices in Cement Production Industry: A Case Study

Vishal Naranje ✉, T. V. S. Chidambaram, Rajeev Bhushan Garg & B. D. Bachchhav

Conference paper | First Online: 26 February 2021



Part of the Lecture Notes in Mechanical Engineering book series (LNME)

## Abstract

Sustainability and environmental stewardship are expected to become increasingly important in the production/manufacturing of the cement. This paper aims to study the sustainability of cement clinker manufacturing industry through analyzing production process, use of alternative fuels, use of waste recovered fuels, energy cost, raw materials, by-products, and energy-efficient methods. The study helps to use these sustainability practices to

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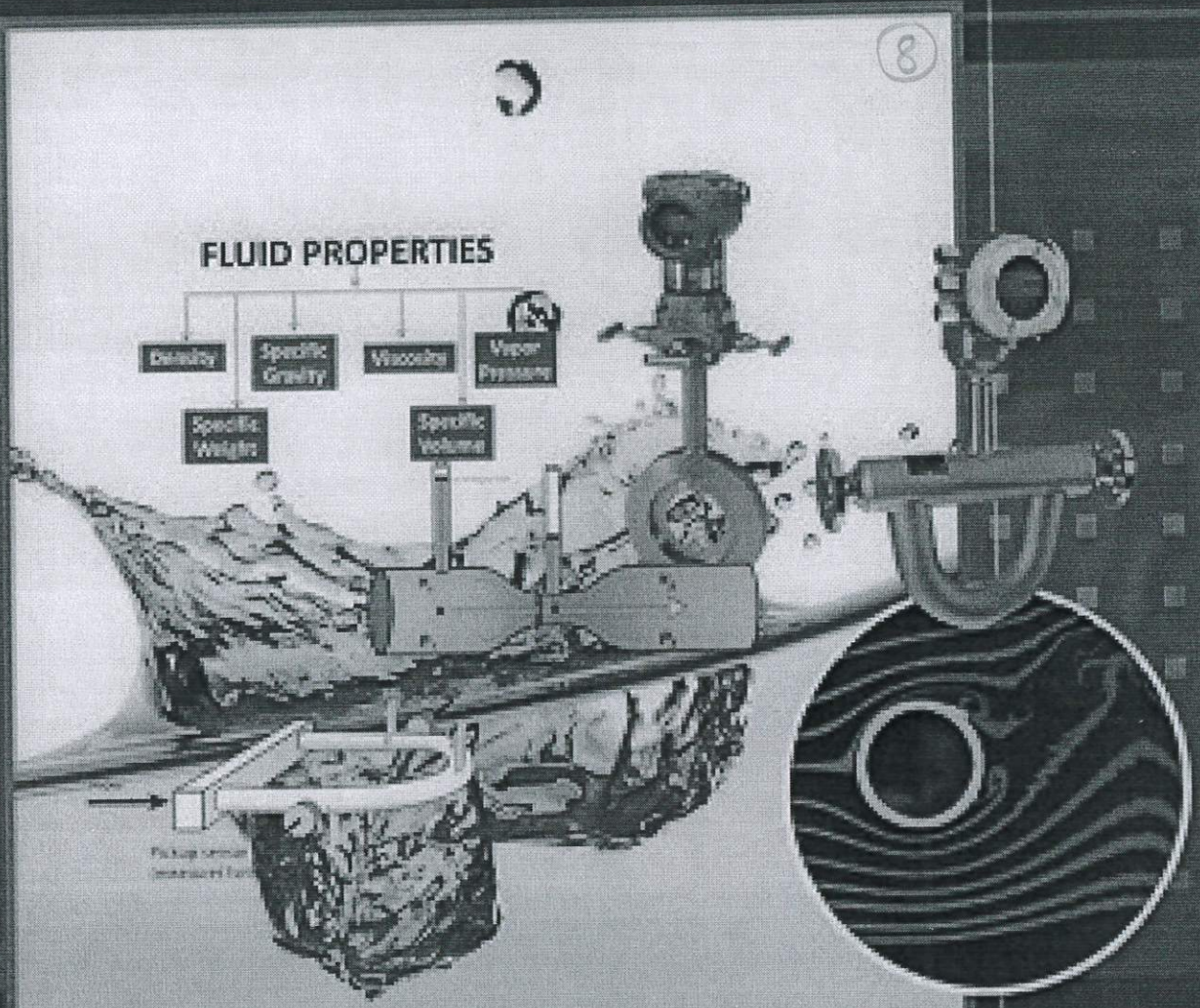


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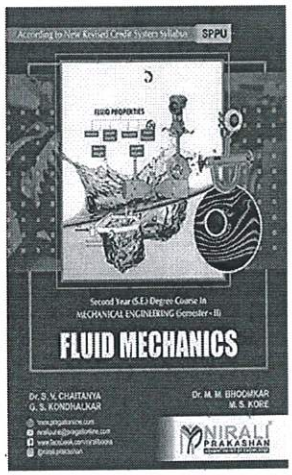


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# A Specific Absorption Rate in Human Head due to Mobile Phone Radiations: Review

Amol D Sonawane
*Research Scholar, AISSMS's Institute of Information and Technology*
*Assistant Professor, RSCOE*
Pune, India
amol.sonawane14@yahoo.com

Dattatraya S Bormane
*Principal and Professor,*
*AISSMS College of Engg.,*
Pune, India
bdattatraya@ yahoo.com

*Abstract*— **In recent years, due to the rapid change in technology, mobile phone usage and subsequently the health complaints is increasing day by day. This may lead to a critical problem if a timely note is not taken. The standard organizations such as ICNIRP, IEEE, and also FCC has already guided the limits on the radiation power radiated by these electronic devices for protecting mankind from overexposure to electromagnetic radiations. Most of the previous studies investigated and show the corelation between the higher risk of biological unwell effects on human health due to the long-term recurrent use of cell phones. In this paper, the health effects due to EM radiations from wireless device specifically from a mobile phone is reviewed.**

***Keywords— Human Head; Mobile Phone; Electromagnetic Energy; Dielectric Tissues Properties; Finite Difference Time Domain; Specific Absorption Rate.***

## I. INTRODUCTION

Whenever the biological ill effects on human health is a serious issue, the EM radiations absorbed by human body prominently comes into the picture. To decide whether mobile phone radiations hazardous to human or not, there is a necessity to investigate detailed true information about previous studies and publish it, to the literate common man about the truth. Many previous studies investigated and shown the relation between the increased risks of biological unwell effects on human health due to the long-term recurrent use of mobile phones. To measure the exposure or power of the electromagnetic radiation absorbed by the human organs, a popular measure Specific Absorption Rate (SAR) is used. SAR measurement can be done with various methods, either whole-body averaged SAR, Local peak SAR or specific absorption. except considering any variationswhich are age-dependent, the water concentration of body, temperature variation and dielectric properties of tissues which may age-dependent in the whole body or head anatomy may underestimate the levels of SAR in the human body.

Many methods are available to evaluate SAR, out of those two renowned methods in which one may be compliance with specific SAR requirements using the electric field strength measurement and another may be thermographic method [4]. The rate of increase in temperature of the tissue-equivalent liquid. It is either using the human head or maybe another part. As per the guidelines given by the ICNIRP, IEEE, 2 W/kg for cell phones basic safety limits. [1] which measured in specific absorption rate (SAR) averaged for 10 grams (g) of tissue. The SAR values of an adult head compared with maximum SAR (10 g) values in children's head using the similler parameters cell phone orientation. By observing the different value of frequencies, effect of the maximum SAR (10 g) for brain layers of the human head and total absorbed powers for children of different age with aged person are observing using the same mobile phone position. The results obtained using the head models which are completely developed and realistic show that for the lower aged children, to meet the acceptable dosimetry level, it may necessary to have a less limit on emmitted power. The electromagnetic energy exposure measurement and analysis in human heads been done using age-dependent adult and children head models. Out of these, some studies have proposed that the EM radiations are found significantly raised level in children than those in adults.[2][3] Basketful proved established technique is available to analyze EM energy absorption in human, still, mankind is in dilemma to choose the correct method which may give reliable and faithful results.

This review wants to acknowledged and summarize the sincere effort taken by previous studies related to correct estimation of EM energy absorption in the whole body, specific body part and its analysis. Specifically, concentrate on a human head (adult and child) which had used various techniques to analyze the exposure of electromagnetic field either in the human body or in a human head. However, More emphasis is given on FDTD age dependant SAR measurement technique in adult head and lower aged child head in this study.

## II. REVIEW OF REPORTED SAR VALUES

### A. Specific Absorption Rate

It is the measure of the rate at which RF energy is absorbed by the body when exposed to the electromagnetic field. It



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# Analysis and Prediction of Temporomandibular Joint Disorder Using Machine Learning Classification Algorithms

**Roopa B. Kakkeri and D. S. Bormane**

**Abstract** Temporomandibular joint disorder (TMD) includes specifically a series of musculoskeletal disorders that may affect the masticating system. Roughly 30–40 percent of adults today have oral problems, and the most common cause of oral problems is TMJ. This disorder is very prevalent in the general population, but it affects more women and young people. The focus of this research review was on the methods for detecting TMJ disorder using machine learning algorithms. Propelled with the rise in use of machine learning techniques in the research dimensions of medical diagnosis, in this paper there is an attempt to explore different classification for predicting the TMJ disorder. The proposed techniques are evaluated on real time TMJ datasets. Dataset related to TMJ screening in subjects had 84 instances and 11 attributes. After applying different machine learning techniques, results suggest that Naïve Bayes and Adaboost models work better with higher accuracy of 93% and 92%.

**Keywords** Temporomandibular joint disorder · Surface electromyography · Machine learning · Classification algorithm · SVM · Naïve Bayes · Adaboost

## 1 Introduction

Today, the issue of TMJ disorder has been growing systematically across all ages of the human population. Early diagnosis of this musculoskeletal condition will significantly aid in maintaining the mental and physical health of the subject [1–3]. With the increase in the use of machine learning-driven models in the forecasts of various human diseases, their early detection now seems to provide promising results based on different health and physiological constraints. We were inspired by this reason to raise awareness in the diagnosis and study of TMJ condition to

R. B. Kakkeri (✉)
AISSMS Institute of Information Technology, Sinhgad Academy of Engineering, Kondwa, Pune, India

D. S. Bormane
AISSMS College of Engineering, SPPU, Kennedy Road, Pune, India


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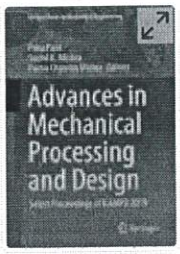


Advances in Mechanical Processing and Design pp 127–138



# Experimental Investigation of Performance and Emissions of Single-Cylinder Diesel Engine Enriched by Hydroxy Gas for Various Compression Ratios

Manoj Dahake, Shrishant Patil & Dileep Malkhede

Conference paper | First Online: 26 November 2020



Part of the Lecture Notes in Mechanical Engineering book series (LNME)

## Abstract

The hydroxy gas due to its carbonless structure is considered as a potential supplement fuel for IC engines. It reduces the burden of energy imports and reduces carbon containing tailpipe emission. Hydroxy gas has unique properties due to the absence of carbon which is considered as better alternative fuel compared to other options such as

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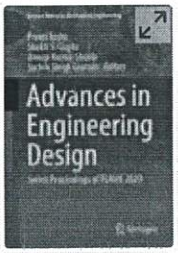


**Advances in Engineering Design** pp 743–750



# Wear Behavior of Polytetrafluoroethylene and Its Composites in Dry Conditions

Priya Gajjal & S. Y. Gajjal

Conference paper | First Online: 01 April 2021



Part of the Lecture Notes in Mechanical Engineering book series (LNME)

## Abstract

In this paper, we investigated the friction and wear behavior of PTFE, bronze, and carbon filled PTFE polymers. Friction and wear tests were done on the Pin on Disc machine. The tests were carried out at load 10, 20, 30 N at a speed of 0.35, 0.66, 0.98 m/s at time intervals. The results show that the friction coefficient in PTFE and its composites decreases with an increase in load. The maximum wear and friction were seen at PTFE and 20% glass fiber.

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# Fuzzy Logic and its Developmental Advances: A Review

*Kalyani N Kulkarni[a], Ravindra K Lad[b]*

[a] *Research Scholar, Department of Civil Engineering, RSCOE, Tathawade, Pune 411033, Maharashtra, India*
[b] *Research Guide, Department of Civil Engineering, RSCOE, Tathawade, Pune,411033, Maharashtra, India*
*Savitribai Phule Pune University, Pune, Maharashtra, India*

ABSTRACT

To date, a lot of research has been done on definition, assumptions, foundation growth, and various theories relevant to the concept of "Fuzzy Logic." Various implementations of the same have been tried and tested in all fields of science, as well as in other fields. The purpose of this paper is to present a condensed version for the developmental approach, journey of Fuzzy logic as a philosophy, as well as all advancements recorded since Lotfi A Zadeh proposed the theory in 1965. "Conventional computer logic couldn't manipulate data that represented subjective or vague ideas, so he created fuzzy logic to allow computers to determine the distinctions among data with shades of grey, similar to the process of human reasoning," he said when introducing his concept of fuzzy logic.

***Keywords-Fuzzy sets, Set theory, linguistic terms, fuzzy data analysis, vagueness.***

## Introduction

The term "fuzzy logic" refers to a type of logic that is a type logical reasoning based on the idea of a "fuzzy set" in mathematics. The word "fuzzy logic" refers to a method of approximate reasoning in a more precise context, but its broadest definition is generally associated with a mathematical theory of classes with undefined, or "fuzzy," boundaries. In Natural Language Processing, fuzzy logic is used in a variety of Artificial Intelligence applications. Expert systems, for example, are modern control systems, make heavy use of fuzzy logic. It is used in Neural Networks because it simulates how people make decisions, but much faster. In a nutshell, fuzzy logic is a variable processing technique that allows many values to be processed by the same variable. Fuzzy logic tries to solve problems using a free, imprecise range of data that allows for a variety of accurate conclusions to be reached. The definition of fuzzy logic is that it focuses on the observation that people make decisions based on inexact and non-numeral evidence. Sets or fuzzy models are mathematical constructs which represent ambiguity and vague data (hence the term fuzzy). It can also be seen in previous research papers that questioned this principle by contrasting it with the concept of "probability." However, further research has shown that it is a logic with parts of a degree of fact. Probability, on the other hand, reflects clear concepts and propositions that are either true or false; a proposition's probability is the degree to which it is true or false defines confidence in its validity. The distinction between fuzzy logic and traditional Boolean algebra has been illustrated in some theories. Fuzzy logic differs from Boolean logic in that it is founded on possibility theory, while Boolean logic is based on probability theory. Fuzzy reasoning has the advantage of being able to reflect the continuous existence of the soil's spatial distribution and attribute distinctness.

## Studies and Developments:

Many negative reactions to Lotfi A Zadeh's The fact that the publications represented the reality that the term "fuzzy" has a negative meaning, according to Lotfi A Zadeh, (2015) [12]. Aristotelian bivalent logic underpins much of science, which is based on classical logic. Binarization is a profoundly ingrained Cartesian tradition of establishing a clear distinction between two groups. This practise has outlived its usefulness, which is not commonly known. One of fuzzy logic's most important from black and white to greyscale. This paper is a succinct summary of his main inputs to the advancement of fuzzy set theory and fuzzy logic, as he saw them. The notion of a fuzzy set, FL-generalization, and the idea of a linguistic variable are all introduced, knowledge particulation, precision of definition, and generalised uncertainty theory are among the contributions discussed (GTU). The knowledge principle, the idea of a restriction,

[a] knkulkarni@aissmscoe.com 9011116974

[b] ravindraklad5@gmail.com 9850214835

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