



I3C4N

## Photoluminescence studies of Terbium doped Calcium Aluminate nanophosphors ( $\text{CaAl}_2\text{O}_4$ : Tb) synthesized by sol-gel method.

M. Freeda<sup>a\*</sup>, T.D. Subash<sup>b</sup>

<sup>a</sup>Assistant Professor, Ponjesly College of Engineering, Nagercoil, Tamil Nadu, India  
<sup>b</sup>Assistant Professor, Holy Grace Academy of Engineering, Trissur, Kerala, India

### Abstract

This paper presents Photoluminescence studies of Terbium doped Calcium Aluminate nanophosphor ( $\text{CaAl}_2\text{O}_4$ : Tb), prepared by sol-gel method. The prepared nanophosphor was characterized by using techniques such as XRD (X-ray diffraction), SEM (Scanning electron microscopy), DRS (Diffuse reflectance spectroscopy), PL (Photoluminescence). XRD analysis confirmed, the monoclinic structure, the particle size was found to be 31 nm and is determined by W-H plot method. The optical bandgap ( $E_g$ ) is found to be 2.7 eV. PL emission is obtained at 395nm, 535 nm corresponds to blue region, green region of the spectrum for 800nm excitation.

© 2017 Elsevier Ltd. All rights reserved.

Selection and Peer-review under responsibility of Conference Committee Members of International Conference on Computing, Communication, Nanophotonics, Nanoscience, Nanomaterials and Nanotechnology.

*Keywords:* XRD; SEM; PL; W-H plot; sol-gel method.

\* Corresponding author. Tel.: +91 8675983137

E-mail address: [freeda321@rediffmail.com](mailto:freeda321@rediffmail.com)

2214-7853 © 2017 Elsevier Ltd. All rights reserved.

Selection and Peer-review under responsibility of Conference Committee Members of International Conference on Computing, Communication, Nanophotonics, Nanoscience, Nanomaterials and Nanotechnology.



PRINCIPAL  
VISAT ENGINEERING COLLEGE  
(Affiliated to APJ AKT University)  
Elanji, Ernakulam - 686 665



I3C4N

## Performance Comparison of 64-bit Carry Look-Ahead Adders Using 32nm CMOS Technology

T.D.Subash<sup>a</sup>, Ajaiyan<sup>b</sup>, T.D.Subha<sup>c</sup>

<sup>a</sup>Head of ECE department, Holy Grace Academy of Engineering, Mala, Thrissur, India

<sup>b</sup>Assistant Professor of ECE Department, Holy Grace Academy of Engineering, Mala, Thrissur, India

<sup>c</sup>Assistant Professor of ECE Department, Holy Grace Academy of Engineering, Mala, Thrissur, India

---

### Abstract

In this paper, MCC carry chain with 8-bit carry chain proposed by Costas Efstathiou and the adder circuits were designed using 32nm CMOS technology with a supply voltage of 0.9v and the effect of temperature on the circuit performance is also analyzed in this work. For 4-bit, the input required are  $a_0$  to  $a_3$  and  $b_0$  to  $b_3$  along with initial carry  $c_{in}$  with the sum output signals as  $s_0$  to  $s_3$  and the carry outputs are  $c_0$  to  $c_3$ . The new high speed MCC requires inputs  $a_0$  to  $a_7$ ,  $b_0$  to  $b_7$ ,  $c_{in}$ , clock and the corresponding outputs are  $c_0$  to  $c_7$  and are implemented by using HSPICE.

© 2017 Published by Elsevier Ltd.

Selection and Peer-review under responsibility of Conference Committee Members of International Conference on Computing, Communication, Nanophotonics, Nanoscience, Nanomaterials and Nanotechnology.

*Keywords:* Conventional domino MCC (Manchester carry chain); CLA (Carry look-ahead adders); multi-output domino logic.

---

2214-7853 © 2017 Published by Elsevier Ltd.

Selection and Peer-review under responsibility of Conference Committee Members of International Conference on Computing, Communication, Nanophotonics, Nanoscience, Nanomaterials and Nanotechnology.



PRINCIPAL  
VISAT ENGINEERING COLLEGE  
(Affiliated to APJ AKT University)  
Elanji, Ernakulam - 686 665



I3C4N

## Comparison of Photoluminescence studies of Lanthanum, Terbium doped Calcium Aluminate nanophosphors (CaAl<sub>2</sub>O<sub>4</sub>: La, CaAl<sub>2</sub>O<sub>4</sub>: Tb) by sol-gel method.

M.Freeda<sup>a\*</sup>, T.D. Subash<sup>b</sup>

<sup>a</sup>Assistant Professor, Department of Physics, Ponjesly College of Engineering, Nagercoil, Tamil Nadu, India

<sup>b</sup>Assistant Professor, Holy Grace Academy of Engineering, Trissur, Kerala, India

### Abstract

This paper presents Photoluminescence studies of Lanthanum, Terbium, doped Calcium Aluminate nanophosphors (CaAl<sub>2</sub>O<sub>4</sub>: La, Tb) prepared by sol-gel method. These phosphors has been characterized by powder X-ray diffraction, scanning electron microscope, Diffuse reflectance spectrometer. Optical properties were studied by photoluminescence spectra. XRD analysis confirmed, the monoclinic structure, the particle size was found to be 27 nm and 31 nm and is determined by (Williamson and Hall plot) W-H plot method. PL emission is obtained at 395nm, 535 nm corresponds to blue, green region of the spectrum for 800 nm excitation. Photoluminescence studies of the prepared phosphors showed near band edge emission and green emission.

© 2017 Elsevier Ltd. All rights reserved.

Selection and Peer-review under responsibility of Conference Committee Members of International Conference on Computing, Communication, Nanophotonics, Nanoscience, Nanomaterials and Nanotechnology.

**Keywords:** X-ray diffraction ; SEM; PL; W-H plot; sol-gel method; Lanthanum; Terbium; DRS

\* Corresponding author. Tel.: 08675983137

E-mail address: [freeda321@rediffmail.com](mailto:freeda321@rediffmail.com)

2214-7853 © 2017 Elsevier Ltd. All rights reserved.

Selection and Peer-review under responsibility of Conference Committee Members of International Conference on Computing, Communication, Nanophotonics, Nanoscience, Nanomaterials and Nanotechnology.



PRINCIPAL  
VISAT ENGINEERING COLLEGE  
(Affiliated to APJ AKT University)  
Elanji, Ernakulam - 686 665



# Indium antimonide based HEMT for RF applications

T. D. Subash<sup>1,†</sup> and T. Gnanasekaran<sup>2,†</sup>

<sup>1</sup>K.N.S.K College of Engineering, Nagercoil-629901, India

<sup>2</sup>RMK College of Engineering and Technology, Tamil Nadu, 601206, India

**Abstract:** We report on an indium antimonide high electron mobility transistor with record cut-off frequency characteristics. For high frequency response it is important to minimize parasitic resistance and capacitance to improve short-channel effects. For analog applications adequate pinch-off behavior is demonstrated. For proper device scaling we need high electron mobility and high electron density. Toward this end, the device design features and simulation are carried out by the Synopsys TCAD tool. A 30 nm InSb HEMT exhibits an excellent cut-off frequency of 586 GHz. To the knowledge of the authors, the obtained cut-off frequency is the highest ever reported in any FET on any material system.

**Key words:** HEMT; InSb; gate length; cut-off frequency; short-channel effects

**DOI:** 10.1088/1674-4926/35/11/113004

**EEACC:** 2570

## 1. Introduction

In the field of communications and imaging, a number of applications are opening up at frequencies above 100 GHz. To offer high gain with low noise and low power consumption, high performance components and circuits are required. InSb-based high electron mobility transistors (HEMTs) and heterojunction bipolar transistors (HBTs) have shown great success in microwave and millimeter-wave applications. Both device technologies are excellent choices for operation in the terahertz regime. In fact, for the last 20 years, InSb based transistors have held the record for frequency response as assessed by the current-gain cut-off frequency  $f_T$  and the maximum oscillation frequency  $f_{max}$ . Current records for  $f_T$  are 765 GHz in pseudomorphic InGaAs/InSb HBTs<sup>[1]</sup> and 610 GHz in pseudomorphic InGaAs/InSb HEMTs<sup>[2]</sup>, and those of  $f_{max}$  are 1.2 THz in HEMTs<sup>[3]</sup> and 800 GHz in HBTs with 80 nm gate length<sup>[4]</sup>. InSb-based InAlAs/In-GaAs HEMTs are the most promising candidates, because they provide high electron mobilities, high saturation velocities, and high sheet electron densities. The results for InSb-based InAlAs/InGaAs are  $f_T$  of 586 GHz and  $f_{max}$  of 712 GHz in HEMTs.

## 2. Device design

Figure 1 shows a schematic diagram of our InSb HEMT. The epitaxial layers of the HEMT were grown on semi-insulating (100) InSb substrates by metal organic chemical vapor deposition (MOCVD). The layers, from bottom to top, consist of a 300 nm InAlAs buffer, 15 nm InGaAs channel, 3 nm InAlAs spacer, Si-doped sheet ( $5 \times 10^{12} \text{ cm}^{-2}$ ), 10 nm InAlAs barrier, 6 nm InSb etching-stopper, and 25 nm Si-doped n-TaSiO<sub>2</sub> capping ( $1 \times 10^{12} \text{ cm}^{-2}$ ) layers. Degradation of the epitaxial structure during fabrication has a strong effect on the DC and RF characteristics of the HEMTs. The Hall mobility  $\mu_n$  and 2DEG sheet carrier density  $n_s$  were measured to be around

13200 cm<sup>2</sup>/(V·s) and  $2.9 \times 10^{12} \text{ cm}^{-2}$  at room temperature, respectively. The fabricated devices bring together novel design features to reduce parasitic capacitance and resistance, to improve short channel effects, and to speed up electron transport: a multilayer and tunneling cap structure to minimize parasitic resistances<sup>[9, 10]</sup>, a very thin channel ( $t_{ch} = 10 \text{ nm}$ ) that is composed of In<sub>0.7</sub>Ga<sub>0.3</sub>As<sup>[6]</sup>, and a narrow-side recess length  $L_{side} = 80 \text{ nm}$ <sup>[13]</sup>. However, reducing  $L_{side}$  often increases parasitic capacitances unless the stem of the T-gate is high enough, which leads to  $f_T$  degradation<sup>[2, 14, 15]</sup>. To mitigate this, we have increased the gate stem to about 150 nm using a SiO<sub>2</sub>-assisted T-gate scheme<sup>[12]</sup>, as shown in Fig. 1. This same SiO<sub>2</sub> layer also passivates the surface of the device.

Device fabrication consists of mesa isolation, alloyed source/drain ohmic contacts, SiO<sub>2</sub> passivation, and finally 30 nm T-gate formation with a Ti/Pt/Au (20/20/350 nm) metal stack by electron-beam lithography. Before gate metallization, a three-step recess process was used, in which the third step determined the final barrier thickness  $t_{ins}$ . As shown in the TEM image of Fig. 1,  $t_{ins}$  and  $L_g$  are 4 and 30 nm, respectively. It is also important to notice that the evaporated gate metal perfectly fills the recessed region of the InAlAs barrier layer, which helps maintain low values of  $R_S$  and  $R_D$ , even with an aggressively scaled barrier.

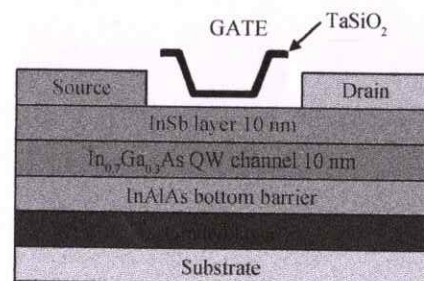


Fig. 1. Schematic cross sectional view of HEMET.

<sup>†</sup> Corresponding author. Email: tdsbush2007@gmail.com; t.gnanasekaran@gmail.com  
Received 27 May 2014



SEMICONDUCTOR MATERIALS

# Indium antimonide based HEMT for RF applications

To cite this article: T. D. Subash and T. Gnanasekaran 2014 *J. Semicond.* **35** 113004

View the [article online](#) for updates and enhancements.

## Related content

- [22 nm In<sub>0.75</sub>Ga<sub>0.25</sub>As channel-based HEMTs on InP/GaAs substrates for future THz applications](#)  
J. Ajayan and D. Nirmal
- [Performance analysis of InSb based QWFET for ultra high speed applications](#)  
T. D. Subash, T. Gnanasekaran and C. Divya
- [Fabrication and characterization of high performance AlGaIn/GaN HEMTs on sapphire with silicon nitride passivation](#)  
Zhang Renping, Yan Wei, Wang Xiaoliang et al.



**PRINCIPAL**  
**VISAT ENGINEERING COLLEGE**  
(Affiliated to APJ AKT University)  
Elanji, Ernakulam - 686 665



## Relative Analysis of GaAs, InSb, InP using QWFET

T.D.Subash<sup>1,a\*</sup>, Dr.T.Gnanasekaran<sup>2,b</sup>, J. Jagannathan<sup>3,c</sup>, C.Divya<sup>4,d</sup>

<sup>1</sup>Assistant Professor, Department of ECE, Infant Jesus College of Engineering and Technology, Tirunelveli

<sup>2</sup>Professor and Head, Department of IT, RMK College of Engineering and Technology, Chennai

<sup>3</sup>Assistant Professor, Centre for Information Technology and Engineering, Manonmaniam Sundaranar University, Tirunelveli

<sup>4</sup>PG Scholar, Centre for Information Technology and Engineering, Manonmaniam Sundaranar University, Tirunelveli

<sup>a</sup>tdsubash2007@gmail.com, <sup>b</sup>t.gnanasekaran@gmail.com,  
<sup>c</sup>jagannathan161091@gmail.com, <sup>d</sup>cdivyame@gmail.com

**Keywords:** InSb, GaAs, InP, QWFET, Quantum well, Band structure.

**Abstract.** Indium Antimonide (InSb) has the greater electron mobility and saturation velocity of any semiconductor. Also InSb detectors are sensitive between 1–5  $\mu\text{m}$  wavelengths and it belongs to III-V [13] component. In this paper we compare the InSb with some other major components like Indium Phosphide (InP) and Gallium Arsenide (GaAs) which are also from same III-V group. The analysis was made using the simulation tool TCAD and using the properties and band structure of those materials we compare InSb with InP and GaAs. The results we proposed shows that InSb is best for ultra high speed and very low power applications.

### Introduction

The III-V compound semiconductor quantum-well field effect transistor (QWFET) is one of the most confident device candidates for upcoming rapid-speed, low-power applications due to its high electron mobility. We report here the results of empirical pseudo potential calculations for GaAs, InP and InSb and compare the obtained values. Fermi to study high-lying atomic states the abstract idea of pseudopotentials was introduced. Subsequently, Hellman proposed that in the alkali metals for calculating the energy levels pseudopotentials are used [1, 17]. Only valence electrons have to be considered while using pseudopotentials this is the main advantage. The spin-free band structures for the  $\Gamma$ , L and X points of the Brillouin zone in InSb, GaAs and InP are calculated using the empirical pseudo potential method resulting from the orthogonalized plane wave method [2]. Conduction in semiconductors is denoted by their band structure - particularly the bandgap of the material denoted by the separation of the conduction and valence bands, and resulting from the quantum mechanical properties of matter. Quantum-corrected Monte Carlo simulation is used to investigate the frequency limits in intrinsic of the nano-scale HEMTs with various channel materials. The higher intrinsic  $f_T$  from the lower  $V_{ds}$  are exhibited in the device with the InSb channel because of the higher electron velocity [3, 13].

### Comparative Study

In this paper we discuss about the basic parameter at 300k of each component with band structure. And also the electric and thermal property was also discussed. The refractive index and absorption index of the three components are discussed. The pseudopotential method is based on the orthogonalized plane wave (OPW) systematic procedure due to Herring. In this systematic procedure, the crystal wavefunction  $\psi_k$  is said to be orthogonal to the core states. This is skillful by expanding  $\psi_k$  as a slick part of symmetrized combinations of Bloch functions  $\phi_k$ , increased with a linear combination of core states. The main beneficial feature of using pseudopotentials is that we have to be considered only valence electrons. The central electrons are treated as in an atomic-like





I3C4N

## Performance Comparison of 64-bit Carry Look-Ahead Adders Using 32nm CMOS Technology

T.D.Subash<sup>a</sup>, Ajaiyan<sup>b</sup>, T.D.Subha<sup>c</sup>

<sup>a</sup>Head of ECE department, Holy Grace Academy of Engineering, Mala, Thrissur, India

<sup>b</sup>Assistant Professor of ECE Department, Holy Grace Academy of Engineering, Mala, Thrissur, India

<sup>c</sup>Assistant Professor of ECE Department, Holy Grace Academy of Engineering, Mala, Thrissur, India

---

### Abstract

In this paper, MCC carry chain with 8-bit carry chain proposed by Costas Efstathiou and the adder circuits were designed using 32nm CMOS technology with a supply voltage of 0.9v and the effect of temperature on the circuit performance is also analyzed in this work. For 4-bit, the input required are  $a_0$  to  $a_3$  and  $b_0$  to  $b_3$  along with initial carry  $c_{in}$  with the sum output signals as  $s_0$  to  $s_3$  and the carry outputs are  $c_0$  to  $c_3$ . The new high speed MCC requires inputs  $a_0$  to  $a_7$ ,  $b_0$  to  $b_7$ ,  $c_{in}$ , clock and the corresponding outputs are  $c_0$  to  $c_7$  and are implemented by using HSPICE.

© 2017 Published by Elsevier Ltd.

Selection and Peer-review under responsibility of Conference Committee Members of International Conference on Computing, Communication, Nanophotonics, Nanoscience, Nanomaterials and Nanotechnology.


*Keywords:* Conventional domino MCC (Manchester carry chain); CLA (Carry look-ahead adders); multi-output domino logic.

---

2214-7853 © 2017 Published by Elsevier Ltd.

Selection and Peer-review under responsibility of Conference Committee Members of International Conference on Computing, Communication, Nanophotonics, Nanoscience, Nanomaterials and Nanotechnology.



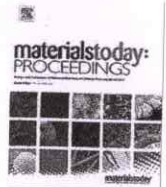
  
**PRINCIPAL**  
VISAT ENGINEERING COLLEGE  
(Affiliated to APJ AKT University)  
Elanji, Ernakulam - 686 665





Contents lists available at ScienceDirect

## Materials Today: Proceedings

journal homepage: [www.elsevier.com/locate/matpr](http://www.elsevier.com/locate/matpr)

# Solar powered two-level cascaded interlaced step-up Dc-Dc converter with MPPT

Jeepa KJ<sup>a</sup>, T.D. Subash<sup>b</sup>, Anjaly V<sup>a</sup>

<sup>a</sup>Department of Electrical and Electronics Engineering, Mangalam College of Engineering, Kottayam, A P J Abdul Kalam Technological University, Kerala, India

<sup>b</sup>Department of Electronics & Communication Engineering, Mangalam College of Engineering, Kottayam, A P J Abdul Kalam Technological University, Kerala, India

## ARTICLE INFO

Article history:  
Available online xxxx

Keywords:  
Concatenated interlaced boost converter  
Photovoltaic  
Maximum Power Point Tracking  
Interlaced Boost converter  
Solar Energy

## ABSTRACT

Here suggests the formation of a pair of CIBC's with raised performance for solar application by employing maximum power point tracking method. The suggested two level CIBC's contains a pair of interlaced boost converter (CIBC) coupled in concatenation to gather the utmost power from sunlight and to supply a rise in output voltage with low ripple. The simulation of PV system and power converters has been done MATLAB/simulink.

© 2021 Elsevier Ltd. All rights reserved.

Selection and peer-review under responsibility of the scientific committee of the International Conference on Nanoelectronics, Nanophotonics, Nanomaterials, Nanobioscience & Nanotechnology.

## 1. Introduction

The much demanded growth for energy the the continual dropping in standing source of fossil fuels and the growing care with respect to environmental pollution have impelled humankind to investigate latest non conventional renewable energy resource like solar, wind energy etc, for the gathering of Structure electricity considering our country collecting sunlight all 12 months of a year. Accordingly utilizing it within the various zones could also be a knowledgeable concept. Solar power is that the foremost plenty cause of energy in the world. Solar energy is not a sole solution for future energy calamity even so an ecologically friendly sort of energy. The energy production using photovoltaic is a systematic approach for executing the solar power. Solar panels are widely used presently to satisfy household application. The price of solar panels has been consistently diminishing which inspires it's in different areas to control.

Photovoltaic (PV) system [4] provides main contributions specifically for the present electricity supply and in addition attractively acceptable because of the zero emission and spending expenses, yet the magnitude of voltage acquired is small and uncontrolled, thus stepping up converters is mandatory to amplify and control the magnitude of the output voltage. Typical step-up converter has a defect of switching loss and low performance. Normally the important aim to try a step-up converter is that these sources operates solely and also transmitting energy to the power grid with a few rising voltage quantities. Even So, the primary boost converter can meet few defects, for example the rise in

voltage can be gained by extending the duty cycle. Still as a result, such as saturation, reverse recovery problem and low performance, the conversion ratio cannot be appreciably, boosted. Nonetheless the power switch undergoes the voltage stress as like the output diode coupled to the load which is almost huge and needs a high cost power switch in the circuit. Another trouble in a step up converter is the demand for continued power in the input and output. Despite the output power in a basic dc-dc converter will discontinue. These drawbacks drives critical ripple at the output and set the output diode in risk of reverse recovery issue [3].

The CIBC is a remedy of this issue that brings a rise in the gain of voltage with small losses and less stress across the switches. Here suggests the formation and simulation of two level CIBC's for utmost power gathering from sunlight with high performance. So here exhibits a formation of a two level concatenated interlaced boost converter (CIBC) for solar application managed by employing maximum power point tracking method [6].

The suggested two level CIBC's contain a pair of interlaced boost converter IBC coupled in concatenation to gather utmost energy from sunlight. Significantly more investigation are in process on making new topologies and numerous ideas for the different applications of boost converter. There are many converter topologies to obtain utmost power from sunlight. The power DC -DC converter has been attending as a extremely dominant part in the form of distinct topologies in several applications. To defect the crucial drawbacks of DC/DC power converters such as high voltage and current ripples, undermost performance etc, interlacing schemes takes part a vital role.

<https://doi.org/10.1016/j.matpr.2021.07.118>

2214-7853/© 2021 Elsevier Ltd. All rights reserved.

Selection and peer-review under responsibility of the scientific committee of the International Conference on Nanoelectronics, Nanophotonics, Nanomaterials, Nanobioscience & Nanotechnology.

Please cite this article as: K. Jeepa, T.D. Subash and V Anjaly, Solar powered two-level cascaded interlaced step-up Dc-Dc converter with MPPT, Materials Today: Proceedings, <https://doi.org/10.1016/j.matpr.2021.07.118>



PRINCIPAL  
VASAT ENGINEERING COLLEGE  
(Affiliated to APJ AKT University)  
Elanji, Ernakulam - 686 665



## Analytical modeling of AlInSb/InSb MOS gate HEMT structure with improved performance

T. D. Subash\*

Department of ECE  
K.N.S.K. College of Engineering  
Nagercoil, Tamilnadu, India  
tdsubash2007@gmail.com

T. Gnanasekaran

Department of IT  
R.M.K. College of Engineering and Technology  
Chennai, Tamilnadu, India  
t.gnanasekaran@gmail.com

P. Deepthi Nair

Department of ECE  
Annai Vailankanni College of Engineering  
Kanyakumari, Tamilnadu, India  
dnambadi@gmail.com

Received 24 September 2014

Accepted 31 December 2015

Published 24 February 2016


The performance of AlInSb/InSb heterostructure with various parameters is considered with T-Cad simulation. As the heterojunctions are having more advantageous properties that is a real support for so many application such as solar cells, semiconductor cells and transistors. Special properties of semiconductors are discussed here with various parameters that are depending up on the performance of accurate device [Pardeshi H., Pati S. K., Raj G., Mohankumar N., Sarkar C. K., *J. Semicond.* **33**(12):124001-1–124001-7, 2012]. The maximum drain current density is achieved with improving the density of two-dimensional electron gas (2DEG) and with high velocity. High electron mobility transistor (HEMT) structure is used with the different combinations of layers which have different bandgaps. Parameters such as electron mobility, bandgap, dielectric constant, etc., are considered differently for each layer [Zhang A., Zhang L., Tang Z., *IEEE Trans. Electron Devices* **61**(3):755–761, 2014]. The high electron mobility electrons are now widely used in so many applications. The proposed work of AlInSb/InSb heterostructure implements the same process which will be a promise for future research works.

**Keywords:** Heterostructure; 2DEG; HEMT; bandgap.

\*Corresponding author.

1672001-1



  
PRINCIPAL  
VISAT ENGINEERING COLLEGE  
(Affiliated to APJ AKT University  
Elanji, Ernakulam)

I3C4N

# Haptic Technology: A comprehensive review on its applications and future prospects

Sreelakshmi M<sup>a</sup>, T. D. Subash<sup>b</sup>

<sup>a</sup>Department of Electronics and Communication Engineering, Holy Grace Academy of Engineering, Thrissur, India.  
Email: [sssreelakshmi7@gmail.com](mailto:sssreelakshmi7@gmail.com)

<sup>b</sup>Department of Electronics and Communication Engineering, Holy Grace Academy of Engineering, Thrissur, India.  
Email: [tdsubash2007@gmail.com](mailto:tdsubash2007@gmail.com)

## Abstract

Computer Science finds a variety of applications in different fields. In the modern scenario, the combination of human senses with field of computer science is becoming more and more common. A detailed study of haptic technology is described in this paper which is entirely related to touch. The complete potential of the field is yet to be explored. The science of applying touch sensation and control to interact with computer developed applications is the best definition given for haptic technology. With the help of Haptic device people get a sense of touch with computer generated environments, so that when virtual objects are touched, they seem to be real and tangible. Haptic technology enables the user to interface with a virtual environment via the sense of touch by applying forces, vibrations, or motions to the user. This mechanical simulation helps in the creation of virtual objects, controlling of virtual objects and to augment the remote control properties of machines and devices. This paper describes how haptic technology works, its devices, applications, and disadvantages. A brief explanation on haptics functions and its implementation in various fields of study is provided in this paper. A description on some of its future applications and a few limitations of this technology is also provided.

© 2017 Elsevier Ltd. All rights reserved.

Selection and Peer-review under responsibility of Conference Committee Members of International Conference on Computing, Communication, Nanophotonics, Nanoscience, Nanomaterials and Nanotechnology.

**Keywords:** Human sense of touch; tactile feedback; Virtual object creation and control; Phantom; Haptic rendering;

## 1. Introduction

From a Greek word *haptikos* the word “haptics” is derived which means pertaining to sense of touch [1]. It is the most recent technology to arrive in the world of computer interface devices which promises to bring thoughtful changes to the way humans interact with information and communicate ideas. Recent advances in computer interface technology now consent us to touch and manipulate imaginary computer-generated objects in a way that evokes a compelling sense of tactile “realness”. Now it is able to sit down at a computer terminal and touch objects that exist only in the “mind” of computer. These interactions are as simple as touching a virtual wall, or as complex as performing a critical procedure in a surgical simulator. Haptics has collectively brought biomechanics, psychology, neurology, engineering and computer in study of human touch and force feedback [4]. Human haptics is the process of manipulation through sensing through tactile and kinaesthetic sensation. Users are able to sense three

2214-7853 © 2017 Elsevier Ltd. All rights reserved.

Selection and Peer-review under responsibility of Conference Committee Members of International Conference on Computing, Communication, Nanophotonics, Nanoscience, Nanomaterials and Nanotechnology.



PRINCIPAL  
VISAT ENGINEERING COLLEGE  
(Affiliated to APJ AKT University)  
Elanjil, Ernakulam - 686 665





I3C4N

## Preparation and Characterization of Praseodymium doped Calcium Aluminate nanophosphor ( $\text{CaAl}_2\text{O}_4:\text{Pr}$ ) by sol-gel method.

M.Freeda<sup>a\*</sup>, T.D. Subash<sup>b</sup>

<sup>a</sup>Assistant Professor, Ponjesly College of Engineering, Nagercoil, Tamil Nadu, India

<sup>b</sup>Assistant Professor, Holy Grace Academy of Engineering, Trissur, Kerala, India

### Abstract

Praseodymium doped Calcium Aluminate nanophosphor ( $\text{CaAl}_2\text{O}_4:\text{Pr}$ ) was prepared by sol-gel method. Characterizations such as XRD, TGA/ DSC, SEM, EDAX, PL were done. Monoclinic structure was confirmed by the XRD analysis. Thermal stability of the prepared sample was studied by TGA/DSC analysis. The particle size was determined by using the Debye Scherrer relation, and (Williamson and Hall plot) W-H plot method. It shows that the particles were of small granular structure, and are interlinked with each other, leads to the formation of bigger particles. Also it is found that some irregular aggregations were formed in the image. PL emission is obtained at 390nm, 520 nm, 790 nm of the spectrum for 360nm excitation.

© 2017 Elsevier Ltd. All rights reserved.

Selection and Peer-review under responsibility of Conference Committee Members of International Conference on Computing, Communication, Nanophotonics, Nanoscience, Nanomaterials and Nanotechnology.

*Keywords:* XRD; TGA /DSC; SEM; EDAX; PL; W-H plot; sol-gel method.

### 1. Introduction

Many phosphors such as  $\text{CaAl}_2\text{O}_4:\text{Eu}^{2+}$ ,  $\text{Dy}^{3+}$  [1] and  $\text{CaAl}_2\text{O}_4:\text{Ce}^{3+}$  [2] were developed for their photoluminescence and high chemical stability. Alkaline earth aluminates  $\text{MAl}_2\text{O}_4$  doped with  $\text{Eu}^{2+}$  activator ion

\* Corresponding author. Tel.: +0 8675983137.

E-mail address: [freeda321@rediffmail.com](mailto:freeda321@rediffmail.com)

2214-7853 © 2017 Elsevier Ltd. All rights reserved.

Selection and Peer-review under responsibility of Conference Committee Members of International Conference on Computing, Communication, Nanophotonics, Nanoscience, Nanomaterials and Nanotechnology.



PRINCIPAL  
VISAT ENGINEERING COLLEGE  
(Affiliated to APJ AKT University)  
Elanji, Ernakulam - 686 665

## Performance analysis of InSb based QWFET for ultra high speed applications

This content has been downloaded from IOPscience. Please scroll down to see the full text.

2015 J. Semicond. 36 014003

(<http://iopscience.iop.org/1674-4926/36/1/014003>)

View [the table of contents for this issue](#), or go to the [journal homepage](#) for more

### Download details:

IP Address: 130.63.180.147

This content was downloaded on 01/03/2015 at 12:36

Please note that [terms and conditions apply](#).



A handwritten signature in blue ink, appearing to be "Principals".

**PRINCIPAL**  
VISAT ENGINEERING COLLEGE  
(Affiliated to APJ AKT University)  
Elanji, Ernakulam - 686 665





Contents lists available at ScienceDirect

## Materials Today: Proceedings

journal homepage: [www.elsevier.com/locate/matpr](http://www.elsevier.com/locate/matpr)

# Modified solar generating panel for high-efficiency solar power station – Using temperature study

Nandhu S. Gopal<sup>a,\*</sup>, T.D. Subash<sup>b</sup>

<sup>a</sup>Department of Electrical and Electronics Engineering, Mangalam College of Engineering, Kerala, India

<sup>b</sup>Department of Electronics and Communication Engineering, Mangalam College of Engineering, Kerala, India

## ARTICLE INFO

## Article history:

Received 19 January 2021

Accepted 20 February 2021

Available online xxx

## Keywords:

Diode parameters

Solar cell

Photovoltaic system

## ABSTRACT

The design of a hybrid solar generation module based on high-efficiency silicon solar cells with a solar radiation mirror concentrator and a solar cell cooling system for the construction of a high-performance solar power station is described in this article. The need for this research is focused on the experimentally proven effect of working temperature and solar radiation power on performance. The need of this work supported through an experiment established influence of the operating temperature and radiation power on the potency of business production semiconducting material solar cells. In planned style, concentrator of radiation provides in 1.5-time increase of power generating by module, and at constant time water-cooling system will doubly scale back potency losses from solar cells heating by reducing the equilibrium temperature of the module up to ten degrees. In apply the conclusion of planned hybrid solar generating module can scale back the quantity of modules required to create solar power station varied temperature studies square measure conducted.

© 2021 Elsevier Ltd. All rights reserved.

Selection and peer-review under responsibility of the scientific committee of the International Conference on Nanoelectronics, Nanophotonics, Nanomaterials, Nanobioscience & Nanotechnology.

## 1. Introduction

Since solar power being the foremost plentiful renewable energy, the huge power generation through it absolutely was a breakthrough in electrical and physical science engineering. By the tip of 2018, international additive put in PV capability reached regarding 512 GW (GW). But the key drawback is just eleven to fifteen of the solar power is reborn to electricity. The common single junction semiconducting material electric cell will turn out a most open-circuit voltage of roughly 0.5 to 0.6 V. Solar cells are delineated as being electrical phenomenon, regardless of whether or not the supply is daylight or a synthetic lightweight. additionally to manufacturing energy, they will be used as a photodetector (for example infrared detectors), detection lightweight or alternative electromagnetic wave close to the visible vary, or measure intensity level. To design the idea of a changed solar generating module equipped with a mirror concentrator of radiation and solar

cells cooling system for victimisation in high performance solar power station.

## 2. Conventional solar cells

A Solar cell is created of semiconductor materials that absorb the photons emitted by the sun and generate a flow of electrons. Photons are elementary particles that carry radiation at a speed of three hundred kilometers per second within the Nineteen Twenties, Albert Einstein said them as “grains of light”. Once the photons strike a semiconductor material like element, they unleash the electrons from its atoms, leaving a vacant house. The stray electrons move around arbitrarily trying to find another “hole” to fill.

To produce an electrical current, however, the electrons have to be compelled to flow within the same direction. This can be achieved victimisation 2 sorts of element. The element layer that's exposed to the sun is doped with atoms of phosphorus, that has an additional lepton than element, whereas the opposite aspect is doped with atoms of B, that has one less lepton. The ensuing sandwich works very like a battery: the layer that has surplus electrons becomes the negative terminal (n) and also the aspect that incorporates a deficit of electrons becomes the positive terminal

\* Corresponding author.

E-mail addresses: [nandhugopal251@gmail.com](mailto:nandhugopal251@gmail.com) (N.S. Gopal), [tdsubash2007@gmail.com](mailto:tdsubash2007@gmail.com) (T.D. Subash).

<https://doi.org/10.1016/j.matpr.2021.02.659>

2214-7853/© 2021 Elsevier Ltd. All rights reserved.

Selection and peer-review under responsibility of the scientific committee of the International Conference on Nanoelectronics, Nanophotonics, Nanomaterials, Nanobioscience & Nanotechnology.



*(Handwritten signature)*

Please cite this article as: N.S. Gopal and T.D. Subash, Modified solar generating panel for high-efficiency solar power station - Using temperature study, Materials Today: Proceedings, <https://doi.org/10.1016/j.matpr.2021.02.659>

PRINCIPAL  
VISAT ENGINEERING COLLEGE  
(Affiliated to APJ AKT University)  
Elanji, Ernakulam - 686 665





Contents lists available at ScienceDirect

## Materials Today: Proceedings

journal homepage: [www.elsevier.com/locate/matpr](http://www.elsevier.com/locate/matpr)Structural, optical and thermal properties of SrAl<sub>4</sub>O<sub>7</sub>:Pr NanophosphorsV.T. Jisha<sup>a,\*</sup>, T.D. Subash<sup>b</sup>, A.C. Sajikumar<sup>a</sup>, G.J. Shyju<sup>a</sup><sup>a</sup>Christian College, Kattakada, Thiruvananthapuram, Kerala, India<sup>b</sup>Mangalam College of Engineering, Ettumanoor, Kottayam, Kerala, India

## ARTICLE INFO

Article history:  
Available online xxx

Keywords:  
XRD  
SEM  
Sol-gel method  
Photoluminescence  
TG

## ABSTRACT

Strontium aluminate nanophosphor doped with Praseodymium was synthesized by sol-gel method. The above synthesized SrAl<sub>4</sub>O<sub>7</sub>:Pr material was characterized by SEM, PXRD, EDAX, TG and PL. By X-ray diffraction analysis monoclinic structure was confirmed. Particle size was calculated by using Scherrer formula. Obtained nano particles are round interlinked shaped and leads to the formation of bigger particle. Under excitation for 360 nm, Photoluminescence emission obtained were at 395 nm, 520 nm 790 nm for UV and Green and IR regions respectively. The TG curve illustrates the three key weight loss measures for Pr doped SrAl<sub>4</sub>O<sub>7</sub>.

© 2021 Elsevier Ltd. All rights reserved.

Selection and peer-review under responsibility of the scientific committee of the International Conference on Nanoelectronics, Nanophotonics, Nanomaterials, Nanobioscience & Nanotechnology.

## 1. Introduction

Some of the crystallite size-dependent properties of rare-earth ions in nano-structured materials are lifetime emission, quantum efficiency and concentration quenching. There are many technical applications for the luminescent properties of these nanomaterials, such as display systems, up-conversion solar cells, white light generation and medical diagnostic equipment detectors[1–3]. Very long afterglow emission exists in long persistent phosphors. Phosphorescence is caused by trapped electrons or holes produced during the excitation. Inorganic phosphors activated by rare earth ions with long-lasting phosphorescence have been studied several times because they have broad practical and potential applications in various fields, like electronic displays, high-energy ray detection such as UV, X-ray, etc[4–5]. The photo luminescence properties of Praseodymium ions incorporated in strontium aluminate (SrAl<sub>4</sub>O<sub>7</sub>:Pr) was focused on this study[6–9]. Luminescence become one of the potential applications of rare earth doped alkaline earth aluminate nano phosphors. The strontium aluminates phosphor's properties strongly depend on material preparation. The different possible synthesis methods of these phosphors are combustion method, co-precipitation method, sol-gel method etc. Fig. 1.

Rare earth doped alkaline earth aluminate's high luminescence efficiency under UV excitation and their ability to maintain their phosphorescence for several hours leads to many researches[10].

Strontium aluminate nano phosphors possess many applications like luminous paints for highways, traffic signs, emergency signs, safety clothes, advertising, airport, buildings, textile industry, the dial plate of glow watches etc. Praseodymium doped Strontium aluminate crystals shows good laser properties. Due to nine fold coordination of two Sr<sup>2+</sup> sites and shorter Sr–O bond length, strong crystal field would cause substantial splitting of the 5d orbitals in rare earth doped SrAl<sub>2</sub>O<sub>4</sub><sup>9</sup>. This may cause broadening of f–f transitions due to multisite occupation of the activator as well electron–phonon interaction<sup>10</sup>. Nano scaled phosphors are being vigorously explained about their physical properties such as size dependent and nanometer leveled sizes. The optical properties have numerous applications, including optical detectors, sensors, lasers, phosphor displays, solidstate lighting, solar cells, photoelectrochemistry, photocatalysis and biomedicine[11–15]. The Nano scaled phosphor's are depending on numerous parameters like size, shape and different variables, along with doping and interplay with the encircling surroundings or different nanostructures[16].

## 2. Experimental

For Sol-gel procedure of synthesizing SrAl<sub>4</sub>O<sub>7</sub>:Pr, 2 M Strontium acetate ((CH<sub>3</sub>COO)<sub>2</sub>Sr·2H<sub>2</sub>O) of 98 wt% was dissolved in 25 ml of 2-methoxyethanol and vigorously stirred. Simultaneously, of 2 M praseodymium nitrate Pr (NO<sub>3</sub>)<sub>3</sub>·6H<sub>2</sub>O of 1 wt% was dissolved in 25 ml of 2-methoxyethanol and vigorously stirred. 2 M Aluminum acetate (C<sub>4</sub>H<sub>6</sub>AlO<sub>4</sub>·4H<sub>2</sub>O) of 1 wt% was dissolved in 25 ml of 2-methoxyethanol with vigorous stirring and, to hit 50 ml in total,

\* Corresponding author.

E-mail address: [drjishavt@gmail.com](mailto:drjishavt@gmail.com) (V.T. Jisha).<https://doi.org/10.1016/j.matpr.2021.06.158>

2214-7853/© 2021 Elsevier Ltd. All rights reserved.

Selection and peer-review under responsibility of the scientific committee of the International Conference on Nanoelectronics, Nanophotonics, Nanomaterials, Nanobioscience &amp; Nanotechnology.



PRINCIPAL  
VISA ENGINEERING COLLEGE  
(Affiliated to APJAKT University)  
Elanji, Ernakulam - 686 665

Please cite this article as: V.T. Jisha, T.D. Subash, A.C. Sajikumar et al., Structural, optical and thermal properties of SrAl<sub>4</sub>O<sub>7</sub>:Pr Nanophosphors, Materials Today: Proceedings, <https://doi.org/10.1016/j.matpr.2021.06.158>





I3C4N

## Optical Characterization of Dysprosium doped Calcium Aluminate Nanophosphor ( $\text{CaAl}_2\text{O}_4: \text{Dy}$ ) by sol-gel method

M. Freeda<sup>a\*</sup>, T.D. Subash<sup>b</sup>

<sup>a</sup>Assistant Professor, Ponjesly College of Engineering, Nagercoil, Tamil Nadu, India

<sup>b</sup>Assistant Professor, Holy Grace Academy of Engineering, Trissur, Kerala, India

### Abstract

The method of sol-gel preparation, Structural, Morphological, Electrical and Optical Characterizations such as XRD, FTIR, SEM, DRS, PL, Dielectric constant of Dysprosium doped Calcium Aluminate nanophosphor ( $\text{CaAl}_2\text{O}_4: \text{Dy}$ ) with different wt. % of Aluminium being varied to 1, 3, 5 and 10 and the wt. % of Dysprosium to be varied as 0.5, 2, 5, 10 wt. % were done. Monoclinic structure was confirmed by the XRD analysis, the particle size was determined by Debye Scherrer method. The band gap ( $E_g$ ) of the prepared samples is estimated. PL emission is obtained at blue, green and IR region of the spectrum for 360nm excitation, corresponding to blue, green region of spectrum. The strong peak, the blue emission at 390 nm was due to the exciton emission, and weak green emission at 520 nm was due to oxygen in the interstitial.

© 2017 Elsevier Ltd. All rights reserved.

Selection and Peer-review under responsibility of Conference Committee Members of International Conference on Computing, Communication, Nanophotonics, Nanoscience, Nanomaterials and Nanotechnology.

**Keywords:** XRD; FTIR; SEM; DRS; PL; Dielectric constant; Debye Scherrer; Monoclinic; Dysprosium.


\* Corresponding author. Tel.: +0 8675983137

E-mail address: [freeda321@rediffmail.com](mailto:freeda321@rediffmail.com)

2214-7853 © 2017 Elsevier Ltd. All rights reserved.

Selection and Peer-review under responsibility of Conference Committee Members of International Conference on Computing, Communication, Nanophotonics, Nanoscience, Nanomaterials and Nanotechnology.



  
PRINCIPAL  
VISAT ENGINEERING COLLEGE  
(Affiliated to APJ AKT University)  
Elanji, Ernakulam - 686 665

## Experimental Investigation On The Distribution Of Voltage At The Stator Winding

K. Kanchana<sup>1</sup>, Anoop K J<sup>2</sup>, Rajini V<sup>3</sup>

<sup>1</sup>Associate Professor, <sup>2,3</sup>Professor, <sup>1,2,3</sup>Department of EEE, <sup>1,2</sup>MBC College of Engineering and Technology, Peermade, Idukki, Kerala, India, <sup>3</sup>SSN College of Engineering, Chennai, Tamilnadu, India

### Abstract

The application of inverter fed induction motors in industrial sector is growing fast due to its ability to line with smooth speed control. However, the most common problem is the appearance of the overvoltage at the motor terminal that leads to a reduction in the life time of the motor. The characteristics impedance difference between cable and induction motor along with the fast switching devices in the motor drive cause high voltage at the terminal of motor. This paper describes investigation of the over voltages based on cable length and rise time through both experiment and simulation. Further, the study of overvoltage is extended to multilevel inverter. Moreover, the distribution of overvoltage across the windings is investigated based on the lumped parameter model. The simulation and experimental results indicated that the voltage stress is more on the first few turns compared to the consecutive turns. Hence, the probability of premature failure of the first turn insulation is very high due to this non-uniform distribution of overvoltage across the winding. Simulation results have been validated using the hardware results

**Keywords:** Induction motor, Over Voltage, Surge Impedance, Multi-level inverter, Voltage distribution..

### 1. Introduction

Overvoltage phenomenon in inverter fed induction motors with long cables is a major area of research for the past two decades. The overvoltage appearing at the motor terminal can be explained using the transmission theory and reflection phenomena. According to the travelling wave theory, the incident voltage generated at the inverter travels through the long cable and gets reflected back at the terminal of motor due to the impedance difference between the cable and the induction motor. The peak value of reflected wave is the function of the switching time of the inverter voltage pulse, characteristic impedance and the cable length [1]-[8].

Analysis and accurate prediction of the overvoltage require a suitable simulation model. The output of the inverter voltage consists of high frequency components and therefore the power frequency model of induction motor and cable are insufficient to analyse the overvoltage phenomenon. The effect of capacitance is considerably large at high frequencies and requires incorporation of the High Frequency (HF) simulation model [9]-[14]. Henceforth, high frequency model of the cable and induction motor are used for the investigation. Further, the analysis has been done for various rise time of the output of inverter voltage and cable length. The investigation proved that voltage distribution across the motor windings is non-uniform. This effect has been examined by using the lumped parameter model of the motor winding. Multilevel inverters are found to be equivalent and advantageous compared to two level inverter for addressing harmonics. In this paper, the analysis is also carried out with multilevel inverter instead of two level inverter in order to study the effect of overvoltage.

### 2. EFFECT OF CABLE LENGTH

The simulation model includes a three phase inverter and a high frequency model of cable and induction motor. This model has been implemented in MATLAB/SIMULINK for the analysis of overvoltage at the





## Building integrated photovoltaics- an overview.

### Construcción de energía fotovoltaica integrada: una descripción general.

Jibi Kurian<sup>1</sup>, Lathi Karthi<sup>2</sup>

<sup>1</sup> PG student, <sup>2</sup> Professor, Head of Department,  
Department of Civil Engineering,  
Toc H Institute of Science and Technology, Kerala, India

Corresponding Author mail id: jibik04@gmail.com

#### ABSTRACT

From the older concept of photovoltaic installation, which includes the addition of solar panels to a building's roof, the construction technology has merged with the photovoltaics technology. The result is Building Integrated Photovoltaics (BIPV), in which integrating the architectural, structural and aesthetic component of photovoltaics into buildings. Building integration of photovoltaics (BIPVs) has been recognized worldwide as a pivotal technology enabling the exploitation of innovative renewable energy sources in buildings, acting as electric power generators within the new framework of smart cities. The standard semitransparent photovoltaic (PV) modules can largely replace architectural glass installed in the building envelopes such as roofs, skylights, and facade of a building. Their main features are power generation and transparency, as well as possessing a heat insulating effect. PV glass shows the same mechanical properties as a conventional, architectural glass used in construction. Additionally, it provides free and clean energy. Given these properties, PV Glass maximizes the performance of the building's envelope. The cost of the PV system and its implementation is still significantly high in comparison to solar thermal systems.

Keywords: Building Integrated Photovoltaics, renewable energy, power generation, heat insulating effect.

#### RESUMEN

Desde el concepto más antiguo de instalación fotovoltaica, que incluye la adición de paneles solares al techo de un edificio, la tecnología de construcción se ha fusionado con la tecnología fotovoltaica. El resultado es Building Integrated Photovoltaics (BIPV), en el que se integra el componente arquitectónico, estructural y estético de la energía fotovoltaica en los edificios. La integración de energía fotovoltaica en edificios (BIPV) ha





# Effect of porous coffee ground biochar on EMI shielding effectiveness of coconut spathe rachilla long fibre-reinforced lightweight vinyl ester biocomposite

K. Kanchana<sup>1</sup> · K. J. Anoop<sup>2</sup> · V. P. Vinod<sup>3</sup> · K. K. Kavitha<sup>4</sup>

Received: 17 May 2023 / Revised: 9 July 2023 / Accepted: 13 July 2023

© The Author(s), under exclusive licence to Springer-Verlag GmbH Germany, part of Springer Nature 2023

## Abstract

The objective of this present research was to create a lightweight vinyl-based electromagnetic interference (EMI) shielding biocomposite using coffee ground porous biochar and coconut spathe rachilla long fibre. The porous biochar was prepared from the waste coffee grounds and the composites were prepared using the hand layup process. According to the findings of this study, adding coconut spathe rachilla long fibre by 40 vol% to the vinyl ester results in increased mechanical, dielectric, and EMI shielding capabilities. However, for 4 vol% porous biochar addition marginally affects the load bearing effects. It is observed that the highest improvement in relative permittivity is 5.24, 4.16, 3.35, and 1.24 at E, F, I, and J band frequencies. Similarly, the maximum observed EMI shielding values for E, F, I, and J bands are about 10.67, 24.71, 40.74, and 52.77 dB when 4.0 vol% of porous biochar particles is added. However, when compared to all composite designations, the highest tensile strength, tensile modulus, flexural strength, flexural modulus, and Izod impact were noted for composite with 2 vol% of biochar (VC2). These highly effective EMI shielding biocomposites with improved mechanical properties could be employed in telecommunication, aerospace, aviation, radar, and radome applications.

**Keywords** Composites · Porous filler · Fibre · Mechanical properties · EMI shielding

## 1 Introduction

Interfering with electromagnetic waves is an outcome of the complexities of electronic devices and systems rising together with their packing density for immediate response. EMI is made up of a lot of unintentionally emitted signals that may significantly decrease the operational efficiency of a system or part of devices [1]. If this EMI is ignored, such issues can seriously harm the electronic equipment's safety functions and communication networks. Moreover,

they may affect the life span of the gadgets and may operate irregularly, malfunction, or stops operation entirely [2]. There are three different methods of EMI reduction phenomenon available either in rigid or flexible form: they are filtering, grounding, and shielding. These phenomena could help minimise or even completely remove the electromagnetic interference (EMI) effect against to the electronic gadgets [3]. The inappropriate signals can be eliminated directly by filtrating them out by using these EMI shielding materials. In such circumstance, passive filtering methods work well as well as are frequently used in new gadgets to lower EMI [4].

For the purpose of avoiding such malfunctions, the electronic and electrical gadgets need to be protected so that the incoming as well as outgoing electromagnetic interferences could be hampered. The most significant approach for eradicating electromagnetic wave's harmful effects at the moment is the development of electromagnetic radiation shielding composite materials [5]. The electromagnetic interfering shielding materials usually made of metals to offer excellent shielding properties at a broad operating frequency ranges. These materials of equipment are bulky because of their inadequate mechanical properties, poor operational life, and higher core density.

✉ K. Kanchana  
kanchana@saveetha.ac.in

<sup>1</sup> Department of Electrical and Electronics, Saveetha Engineering College, Chennai, India

<sup>2</sup> Department of Electrical and Electronics, VISAT Engineering College, Ernakulam, Kerala, India

<sup>3</sup> Department of Electrical and Electronics, Sree Buddha Engineering College of Engineering, Alappuzha, Kerala, India

<sup>4</sup> Department of Environmental and Herbal Science, Tamil University, Thanjavur, India

Published online: 28 July 2023



PRINCIPAL  
VISAT ENGINEERING COLLEGE  
(Affiliated to APJ AKT University)  
Elanji, Ernakulam - 686 665

Springer



# Design and Implementation of Electric Bike with Gear

Amal suresh<sup>1</sup>, Geo jose<sup>2</sup>, Visakh MS<sup>3</sup>, Vipin benny<sup>4</sup>, Anoop K J<sup>5</sup>,

<sup>1,2,3,4</sup>UG Students, <sup>5</sup>Professor, Department of EEE,

Mar Baselios Christian College of Engineering and Technology, Kuttikkanam, Kerala, India

**Abstract** – Nowadays, several countries in the world face with the issue of air pollution due to the emission of carbon by the operation of transports and industry. The fossil fuels that are utilized in the urban transport are one of the key intensifying factors. Among the assorted types of the electric vehicles, the two wheels electric vehicle like electric bicycle, bike and scooter can play a crucial role in reducing urban traffic and sound pollution. Regarding to the aforementioned points, several researchers around the world are concerned in the design process of these types of vehicles. As the level of pollution in the world is rising, the adoption of electric vehicles are precisely the best option. Electric vehicles can also reduce the emissions that contribute to climate change, smog, improving public health and reducing ecological damage. The operation of the Electric vehicles on renewable energy such as solar or wind minimizes these emissions even more. This paper focuses on the design of an electric bike with a gear system. Since the gear system is usually preferred by most of the two-wheel drivers, this research focused to the design of a geared electric bike. The design of electric scooter suggested by the investigators has less speed range and no gear. In order to overcome the problems, proposed design is incorporated with a gear system to get a speed range of 0-80 km/h. Aurdino Uno 3 controller is used to control the speed of the bike. This innovative technique will attract consumers which in turn improve the market strategy.

**Key words:** electric bike, BLDC motor, gear system, Li-ion Battery, Uno Controller

## I. Introduction

‘There are 1.2 billion vehicles are on world’s roads now, and it is expected to be 2 billion by 2035 [1]. Almost all the vehicles are depending on petroleum for their transportation. According to a very recent estimate earth’s petroleum resources become fully exhausted within 50 years and thereby IC engine driven vehicles will be no longer available [2]. This may result into a revolution of electric vehicle soon. Hence this paper deals with the design and implementation of an electric bike with gear system.

Besides the advantages over fuel, there is no sound pollution and air pollution for electric vehicle [3]. Many R & D studies were done in this specific area and many electric scooters are now on the road [4]. The maximum speed of these

vehicles is 40 km/ph and they are driven by DC motors. The energy storage system used is lead acid batteries.

In this proposed work Brush Less DC (BLDC) motor is used to drive the vehicle. Li-ion battery supplies input power to drive the motor. The design includes a four gear system for the transmission. Uno based Aurdino controller system is used for controlling the speed of the motor.

## II. Design Methodology

The key factor of the design of the proposed electric bike includes the selection of motor, battery and controller.

### (A) BLDC MOTOR

Previously, electrical vehicles were run by using dc series and induction motor and nowadays that are replaced by BLDC motor.

BLDC motor shown in figure 1 is a conventional type of synchronous motor widely used in electric bikes owing to the advantages of high starting torque and longer life. The absences of brushes even increase the efficiency.

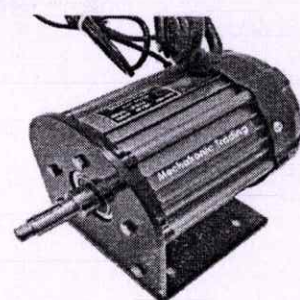


Fig.1 BLDC motor

### (B) Design equations

Total resistance ( $T_R$ ) offered by the bike is shown in equation

$$T_R = R_R + A_R + G_R \quad (1)$$

In the above equation (2)  $R_R$  is the rolling resistance,  $A_R$  is the air resistance and  $G_R$  represents the gradient resistance.



## Suppression of over voltage in SiC-based inverter fed induction motor

Ayodeji Olalekan Salau<sup>a,b</sup>, Kadirvel Kanchana<sup>c</sup>, Kuttichakku Johny Anoop<sup>d</sup>, Elisha Didam Markus<sup>e</sup> and Sepiribo Lucky Braide<sup>f</sup>

<sup>a</sup>Department of Electrical/Electronics and Computer Engineering, Afe Babalola University, Ado-Ekiti, Nigeria; <sup>b</sup>Saveetha School of Engineering, Saveetha Institute of Medical and Technical Sciences, Chennai, Tamil Nadu, India; <sup>c</sup>Department of Electrical Electronics Engineering, Saveetha Engineering College, Chennai, India; <sup>d</sup>Department of Electrical and Electronics Engineering, VISAT Engineering College, Ernakulam, Kerala, India; <sup>e</sup>Department of Electrical/Electronic and Computer Engineering, Central University of Technology, Bloemfontein, Free State, South Africa; <sup>f</sup>Department of Electrical/Electronic Engineering, University of Port Harcourt, Choba, Rivers State, Nigeria

### ABSTRACT

Silicon carbide (SiC) based inverters are widely used due to their fast switching and ability to withstand high temperatures and Voltage. This helps to increase efficiency and reduces switching losses compared to the silicon-based inverter. However, this fast-switching device causes an increase in the Voltage at the junction of the cable and motor due to the reflected wave. The main causes of overvoltage are cable/motor impedance mismatch, fast-switching inverter devices (IGBT), and inverter-motor separation. To extend the induction motor lifespan, overvoltage reduction is necessary. Passive and active filters solve the problem, but passive filters are bulky and have high power loss. This paper presents a shunt active filter approach for an inverter-fed induction motor to reduce overvoltage. To show the effectiveness of the proposed approach, the findings were compared to the topology of the clamp-type active filter already in use. The shunt active filter used Proportional Integral (PI) and fuzzy controllers to generate reference current according to the Synchronous Reference Frame (SRF) theory. Harmonics in the power system were removed using the SRF theory. The unique aspect of this work is how the reference current is produced in the shunt active filter using the SRF theory. The proposed shunt active filter with a fuzzy controller was added to the hardware implementation to achieve better results than previous active filters.

### ARTICLE HISTORY

Received 18 April 2023  
Accepted 26 July 2023

### KEYWORDS

SiC-based inverter; SRF; active filter; Over voltage

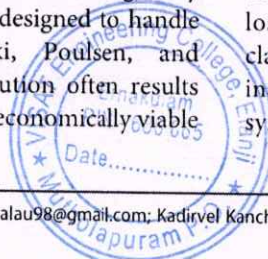
## 1. Introduction

Wide bandgap devices such as silicon carbide (SiC) based inverter are recently in high demand due to their high voltage withstanding capability, high switching frequency, high efficiency, faster switching speed, and low weight. However, the occurrence of overvoltage at the motor terminal due to the reflected voltage is exacerbated by their quick switching speed. This overvoltage can lead to insulation break-down, increased losses, and reduced motor lifespan. To mitigate this issue, various techniques have been proposed in the literature. Table 1 presents an exhaustive literature review along with its corresponding findings (Chander et al. 2022a, 2022b; Chen et al. 2023; De Caro et al. 2017; Fard et al. 2023; Lackie et al. 2023; Narayanasamy et al. 2020; Scott et al. 2014; Xu et al. 2021; Zhang et al. 2021; Zhang, Li, and Peng 2021; Zhou et al. 2022, 2023; Zhou, Yuan, and Laird 2019).

One approach to reducing terminal overvoltage is by incorporating improved insulation designed to handle high-voltage stress (Hanigovszki, Poulsen, and Blaabjerg 2004). However, this solution often results in an oversized motor, which is not economically viable

(Hanigovszki, Poulsen, and Blaabjerg 2004). Another option is to instal appropriate filters to suppress the overvoltage (Alessandro et al. 2002; Hanigovszki, Poulsen, and Blaabjerg 2004). Passive filters have been extensively studied and found to be economically viable and effective in reducing overvoltage (Kanchana and Rajini 2017; Kanchana, Anoop, and Rajini 2020; Von Jouanne et al. 1996). However, these filters increase the system size and have significant power losses, including core losses from high-frequency pulses (Kanchana and Rajini 2014).

To address these challenges, active filters have been introduced as a solution to reduce overvoltage in inverter-fed induction motors (Yuen, Chung, and Cheung 2012). Yuen *et al.* (Yuen, Chung, and Cheung 2012) proposed an active filter with a diode clamp, which effectively reduced electromagnetic interference, shaft voltage, and bearing current, thereby increasing the bearing lifetime. Moreover, the active filter approach helps to minimise energy losses during the impedance-matching process by clamping and lengthening the rising time of the terminal voltage (Yuen, Chung, and Cheung 2012). The synchronous modulation technique is also employed







# Improved DC Performance Analysis of a Novel Asymmetric Extended Source Tunnel FET for Fast Switching Application

Ritam Dutta<sup>1,3</sup>, T. D. Subash<sup>2</sup>, Nitai Paitya<sup>3</sup>

Received: 19 March 2021 / Accepted: XXXXXXXXXXXXX  
© Springer Nature B.V. 2021

## Abstract

A two-dimensional analytical model for asymmetric extended source tunnel field effect transistor (AES-TFET) has been developed to obtain better device performance. The proposed device model has been analytically modelled and performed by solving 2-D Poisson's equation. Surface potential distribution, electric field variation and band-to-band tunneling (BTBT) rate have been investigated by this numerical modelling. The source region of novel structure of TFET has been extended (varied 2 nm to 6 nm) to incorporate corner effect, which allows BTBT through a thin tunneling barrier, with controlled ambipolar conduction. This eventually produces better source-channel interface tunneling for a *n*-channel AES-TFET. 2-D numerical device simulator (SILVACO TCAD) has been used for simulation work. The simulated work has been finally validated by analytical modelling of AES-TFET. Better  $I_{ON}$ ,  $I_{OFF}$  and switching ratio has been obtained from this novel TFET structure.

**Keywords** AES-TFET · Surface potential distribution · Electric field variation · BTBT · TCAD · Numerical modelling.

## 1 Introduction

With the advent of nanoscience and nanotechnology in nano-scaled devices, the physical sizes of transistors have been scaled down categorically. By following the Moore's law prediction in 2022, the miniaturization has reached its limit for metal oxide field effect transistors (MOSFETs) [1]. In this connection, various scaling issues has been emerged in last two decades viz. short channel effects (SCE), drain induced barrier lowering (DIBL) [2]. To overcome these issues, continuous research is going on in novel structures of MOSFETs. But in present scenario, the limited subthreshold swing (SS) of MOSFETs at around 60mV/decade has been a major drawback for researchers.

Keeping all device parameter scaling issues in mind, a new device physics has been inculcated in nanodevice engineering. In this case quantum tunneling has been introduced as a solid replacement of earlier FETs [3]. The typical energy band structure with ultra-thin barrier helped researchers to develop tunneling junction devices (TJD) using band to band tunneling (BTBT) phenomenon. In this paper, prior to this work, several literatures were surveyed based on structural and material engineering [4-14]. The effect of homogeneous and heterogeneous material in tunneling junctions [15], effect of pocket intrinsic doping on single as well as multi gate tunneling FETs [16-17], effect of device performance based on various high-*k* materials [18], stress-strain effects in source-channel (*n*-channel) and drain-channel (*p*-channel) TJDs [19], usage of carbon nano-tubes (CNT) in tunneling FETs [20], nano-wire tunneling FETs [21], capacitive effects in modified TJD structures [22], various symmetric and asymmetric tunneling device structures has been studied to meet the earlier mentioned scaling issues and device performance factors.

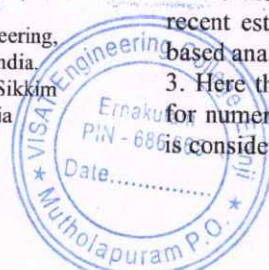
In our paper the typical extended design of source region has been modelled to introduce corner effect in source-channel junction for *n*-channel TFET. The entire device structure details have been mentioned in section 2, where the typical device parameters are used based on recent established literature survey. The device physics based analytical modelling has been introduced in section 3. Here the two-dimensional Poisson's equation is used for numerical analysis. Parabolic approximation method is considered for potential distribution analysis across the

Ritam Dutta  
ritamdutta1986@gmail.com

T. D. Subash  
tdsubash2007@gmail.com

Nitai Paitya  
nitai.p@smit.smu.edu.in

- 1 Department of Electronics and Comm. Engineering, Surendra Institute of Engineering & Management, West Bengal-734009, India
- 2 Department of Electrical and Electronics Engineering, Mangalam College of Engineering, Kerala -686631, India.
- 3 Department of Computer Sc. and Engineering, Sikkim Manipal Institute of Technology, Sikkim-737136, India



VISAT ENGINEERING COLLEGE  
(Affiliated to APJ AKT University)  
Elanji, Ernakulam - 686 665

Springer



# ANALYSIS AND DESIGN OF MULTI-STOREY BUILDING USING WITH L-SHAPED COLUMN

Aron K Shibu <sup>1</sup>, Alan Joy <sup>2</sup>, Anjana G R <sup>3</sup>, Kevin Sam Mathew <sup>4</sup>, Anagha R<sup>5</sup>

<sup>1</sup> Student, Department of Civil Engineering, VISAT, Kerala, India

<sup>2</sup> Student, Department of Civil Engineering, VISAT, Kerala, India

<sup>3</sup> Student, Department of Civil Engineering, VISAT, Kerala, India

<sup>4</sup> Student, Department of Civil Engineering, VISAT, Kerala, India

<sup>5</sup> Assistant Professor, Department of Civil Engineering, VISAT, Kerala, India

## ABSTRACT

The behavior of irregular shaped reinforced concrete columns has been a constant concern to design a safe and economic structure buildings. In this project, we examine the performance of L-shaped columns by replacing normal columns. The L-shaped columns are used as corner columns in building. In this project we have analyzed the 3-storey commercial building with L shaped columns at corners. The analysis is done by using the software ETABS. The multi-storey building is designed using software AUTOCAD. Axial load and Moment capacity of normal column and L-shaped reinforced concrete columns have been done in this work and compared. Comparison between analysis with Normal column and analysis with L shaped column is done. The results shows that such new type L-shaped columns exhibited high axial strength. L shaped columns avoid prominent corners in the building which increases usable floor area. The L shaped columns in R.C. building gives better seismic performance than normal columns.

**Keyword :** - L-shaped columns, ETABS, analysis.

## 1. INTRODUCTION

A structure is an assemblage of individual elements like pinned elements (truss elements), beam element, column, shear wall slab cable or arch. Structural engineering is concerned with the planning, designing and the construction of structures. Structure analysis involves the determination of the forces and displacements of the structures or components of a structure. Design process involves the selection and detailing of the components that make up the structural system. The main object of reinforced concrete design is to achieve a structure that will result in a safe economical solution.

Special-shaped columns have been widely applied as the load-carrying portion at corner of rooms in multi-story buildings in recent years. The special-shaped columns have satisfied the requirement of the architects and save more space to earn economic benefits. As the reinforced concrete (RC) structures are the most widely used in buildings, the special-shaped RC columns are firstly applied in structures. Special-shaped columns can be embedded into walls and thus help avoid column protrusion, making them beneficial from an architectural design viewpoint. L-, T-, cross- and Z-shaped reinforced concrete columns have frequently been employed in residential structures. However, such columns fail to meet the requirements of high-rise buildings with respect to heavy loads such as might occur during strong earth quakes. These problems have restricted the development of special-shaped columns, and addressing them requires further research.





# REDESIGN OF G+2 STOREY CONCRETE STRUCTURE TO STEEL, USING ETABS

Adithya Saran P V<sup>1</sup>, Aparna Raju<sup>2</sup>, Dhanyamol Samuel<sup>3</sup>, Jayakrishna Menon<sup>4</sup>,

Aleena Elizabeth Jose<sup>5</sup>

<sup>1</sup> Adithya Saran P V, Civil Engineering Department, VISAT Engineering College, Ernakulam, India

<sup>2</sup> Aparna Raju, Civil Engineering Department, VISAT Engineering College, Ernakulam, India

<sup>3</sup> Dhanyamol Samuel, Civil Engineering Department, VISAT Engineering College, Ernakulam, India

<sup>4</sup> Jayakrishna Menon, Civil Engineering Department, VISAT Engineering College, Ernakulam, India

<sup>5</sup> Aleena Elizabeth Jose, Assistant Professor, Civil Engineering Department, VISAT Engineering College, Ernakulam, India

## ABSTRACT

Short construction period leads to savings in site preliminaries, earlier return on investment and reduced interest charges. Time related savings can easily amount to 3% to 5% of the overall project value, reducing the client's requirements for working capital and improving cash flow. In many inner-city projects, it is important to reduce disruption to nearby buildings and roads. Steel construction dramatically reduces the impact of the construction operation on the locality. Steel offers better 'elasticity'. Concrete is more brittle and thus less suited for skyscrapers which are designed to sway with the wind. In this study, a comparative analysis of steel and concrete structures of an ongoing project of Govt. Ayurveda Hospital is carried out. It is a G+2 storey building built as a concrete structure. We focus on redesigning the concrete structure using steel. Steel structure is a structure which is made from the organized combination of custom designed structural steel members to meet architecture and engineering requirements of users. Steel structure involves substructure or members in a building made from structural steel.

**Keyword:** - steel structure, concrete structure, ETABS, analysis

## 1. INTRODUCTION

Steel design, or more specifically, structural steel design, is an area of structural engineering used to design steel structures. These structures include schools, houses, bridges, commercial centers, tall buildings, warehouses, aircraft, ships and stadiums. The design and use of steel frames are commonly employed in the design of steel structures. More advanced structures include steel plates and shells. In structural engineering, a structure is a body or combination of pieces of the rigid bodies in space that form a fitness system for supporting loads and resisting moments. The effects of loads and moments on structures are determined through structural analysis. A steel structure is composed of structural members that are made of steel, usually with standard cross sectional profiles and standards of chemical composition and mechanical properties.

## 2. LITERATURE REVIEW

Many authors have reported the use of steel in various civil engineering applications.

**Neeraj Agarwal, Nikhil Garg (2018)** A regular floor plan of 3370 sq.m size is considered in this report. Structural steel used in the building is 350 Grade steels.

**Shubhankar, Mishra, Manas Rathore (2021)** ETABS Structural Analysis is the branch in which we determine the behavior of structures through which we can predict the responses of different structural components under effect of different types of loads.







# Physics Based Analytical Modeling of Asymmetric Elevated Source Tunnel FET (AES-TFET) for Better Tunnel Junction Device (TJD) Performance

Ritam Dutta<sup>1,3</sup>, T. D. Subash<sup>2</sup>, Nitai Paitya<sup>3</sup>

Received: 26 February 2021 / Accepted: XXXXXXXXXXXXX  
© Springer Nature B.V. 2021

## Abstract

In this paper, a two-dimensional analytical model for asymmetric elevated source tunnel field effect transistor (AES-TFET) has been developed to obtain better tunnel junction device performance. Device physics based analytical modelling is performed by solving 2-D Poisson's equation. Surface potential distribution, electric field variation and band-to-band tunneling (B2B) rate have been investigated by this numerical modelling. In our proposed structure, the source has been elevated (varied 2 nm to 6 nm) to incorporate corner effect; which boosts the carrier transport via thin tunneling barrier, with controlled ambipolar conduction. This eventually produces better source-channel interface tunneling for a *n*-channel AES-TFET structure. 2-D numerical device simulator (SILVACO TCAD) has been used for simulation work. The simulated graphical representations have been finally validated by analytical modelling of AES-TFET.

**Keywords** AES-TFET · Surface potential distribution · Electric field variation · B2B tunneling · TCAD · Numerical modelling.

## 1 Introduction

With the advent of nanoscience and nanotechnology in nano-scaled devices, the physical sizes of transistors have been scaled down categorically. By following the Moore's law prediction in 2022, the miniaturization has reached its limit for metal oxide field effect transistors (MOSFETs) [1]. In this connection, various scaling issues has been emerged in last two decades viz. short channel effects (SCE), drain induced barrier lowering (DIBL) [2]. To overcome these issues, continuous research is going on in novel structures of MOSFETs. But in present scenario, the limited subthreshold swing (SS) of MOSFETs at around 60mV/decade has been a major drawback for researchers.

Keeping all device parameter scaling issues in mind, a new device physics has been inculcated in nanodevice engineering. In this case quantum tunneling has been introduced as a solid replacement of earlier FETs [3]. The typical energy band structure with ultra-thin barrier helped researchers to develop tunneling junction devices (TJD) using band to band (B2B) tunneling phenomenon. In this paper, prior to this work, several literatures were surveyed based on structural and material engineering [4-14]. The effect of homogeneous and heterogeneous material in tunneling junctions [15], effect of pocket intrinsic doping on single as well as multi gate tunneling FETs [16-17], effect of device performance based on various high-*k* materials [18], stress-strain effects in source-channel (*n*-channel) and drain-channel (*p*-channel) TJDs [19], usage of carbon nano-tubes (CNT) in tunneling FETs [20], nano-wire tunneling FETs [21], capacitive effects in modified TJD structures [22], various symmetric and asymmetric tunneling device structures has been studied to meet the earlier mentioned scaling issues and device performance factors.

In our paper the typical elevated design of source region has been modelled to introduce corner effect in source-channel junction for *n*-channel TFET. The entire device structure details have been mentioned in section 2, where the typical device parameters are used based on recent established literature survey. The device physics based analytical modelling has been introduced in section 3. Here the two-dimensional Poisson's equation is used for numerical analysis. Parabolic approximation method is considered for potential distribution analysis across the

Ritam Dutta  
ritamdutta1986@gmail.com

T. D. Subash  
tdsubash2007@gmail.com

Nitai Paitya  
nitai.p@smit.smu.edu.in

- 1 Department of Electronics and Comm. Engineering, Surendra Institute of Engineering & Management, West Bengal-734009, India
- 2 Department of Electrical and Electronics Engineering, Mangalam College of Engineering, Kerala -686631, India.
- 3 Department of Computer Sc. and Engineering, Sikkim Manipal Institute of Technology, Sikkim-737136, India







Article Title: Delay and Sum Beam forming Technique to Detect the Arrival Estimation of Sound Waves

## **Delay and Sum Beam forming Technique to Detect the Arrival Estimation of Sound Waves**

**Naeema Nazar, Dr. Perumal Sankar**

Department of Electronics and Communication, Toc H Institute of Science & Technology, A PJ  
Abdul Kalam Technological University, Ernakulam, Kerala, India

Email: naeemanazarcn@gmail.com

### **ABSTRACT**

This research aims to enhance the accuracy of Direction of Arrival (DOA) estimation using hydrophone arrays through the application of beamforming methods, particularly focusing on the Delay and Sum Beamforming technique. The study follows a systematic approach, utilizing Matlab for signal generation, analysis, and testing, accompanied by power plots. It also includes a series of steps for the analysis and testing of Delay and Sum Beamforming. The investigation compares traditional DOA estimation methods with Delay and Sum Beamforming and proposes future enhancements, such as exploring alternative beamforming techniques and potential applications of advanced methods like Deep Neural Networks.

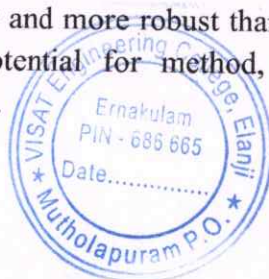
**Keywords:** Direction of arrival (DOA) estimation, Delay and sum (DAS) beamforming, Hydrophone array

### **1 Introduction**

This research focuses on direction of arrival (DOA) sensitivity, resolution, and dynamic range. Therefore, estimation in the marine environment. Traditional there is a need for efficient solutions to improve the methods have limitations, while beamforming offers efficiency of marine operations and advance research in advantages like better dynamic range and accurate DOA this field estimates. We explore target localization using the delay and sum beamforming algorithm, which is valuable for

#### **1.1 Theoretical comparison**

Underwater applications. Power plot analyses, sum Delay and sum (DAS) beamforming offers advantages analyses and comparisons with traditional methods are over traditional methods. It achieves higher accuracy performed. While delay and sum beamforming has with fewer sensors, reducing the array size requirement limitations, incorporating techniques like adaptive compared to time delay estimation. DAS beamforming beam forming and exploring deep neural networks can is simpler and more robust than the phase comparison enhance the system's performance, offering potential for method, as it only relies on time delay calculations. It future improvements.



**PRINCIPAL**  
VISAT ENGINEERING COLLEGE  
(Affiliated to APJ AKT University)  
Elanji, Ernakulam - 686 665



# ANALYSIS AND DESIGN OF MULTI-STOREY BUILDING USING WITH L-SHAPED COLUMN

Aron K Shibu <sup>1</sup>, Alan Joy <sup>2</sup>, Anjana G R <sup>3</sup>, Kevin Sam Mathew <sup>4</sup>, Anagha R <sup>5</sup>

<sup>1</sup> Student, Department of Civil Engineering, VISAT, Kerala, India

<sup>2</sup> Student, Department of Civil Engineering, VISAT, Kerala, India

<sup>3</sup> Student, Department of Civil Engineering, VISAT, Kerala, India

<sup>4</sup> Student, Department of Civil Engineering, VISAT, Kerala, India

<sup>5</sup> Assistant Professor, Department of Civil Engineering, VISAT, Kerala, India

## ABSTRACT

The behavior of irregular shaped reinforced concrete columns has been a constant concern to design a safe and economic structure buildings. In this project, we examine the performance of L-shaped columns by replacing normal columns. The L-shaped columns are used as corner columns in building. In this project we have analyzed the 3-storey commercial building with L shaped columns at corners. The analysis is done by using the software ETABS. The multi-storey building is designed using software AUTOCAD. Axial load and Moment capacity of normal column and L-shaped reinforced concrete columns have been done in this work and compared. Comparison between analysis with Normal column and analysis with L shaped column is done. The results shows that such new type L-shaped columns exhibited high axial strength. L shaped columns avoid prominent corners in the building which increases usable floor area. The L shaped columns in R.C. building gives better seismic performance than normal columns.

**Keyword** :- L-shaped columns, ETABS, analysis.

## 1. INTRODUCTION

A structure is an assemblage of individual elements like pinned elements (truss elements), beam element, column, shear wall slab cable or arch. Structural engineering is concerned with the planning, designing and the construction of structures. Structure analysis involves the determination of the forces and displacements of the structures or components of a structure. Design process involves the selection and detailing of the components that make up the structural system. The main object of reinforced concrete design is to achieve a structure that will result in a safe economical solution.

Special-shaped columns have been widely applied as the load-carrying portion at corner of rooms in multi-story buildings in recent years. The special-shaped columns have satisfied the requirement of the architects and save more space to earn economic benefits. As the reinforced concrete (RC) structures are the most widely used in buildings, the special-shaped RC columns are firstly applied in structures. Special-shaped columns can be embedded into walls and thus help avoid column protrusion, making them beneficial from an architectural design viewpoint. L-, T-, cross- and Z-shaped reinforced concrete columns have frequently been employed in residential structures. However, such columns fail to meet the requirements of high-rise buildings with respect to heavy loads such as might occur during strong earth quakes. These problems have restricted the development of special-shaped columns, and addressing them requires further research.

