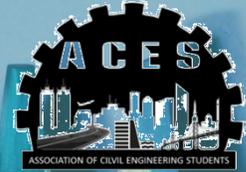




Vidya Vikas Education Trust's  
Universal College Of Engineering  
Kaman, Vasai - 401 212  
Department of Civil Engineering



# The Benchmark

Issue 004: November 2018 Edition

ACES InExCon

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## *Words of Wisdom*

### *Drishti*

*Use of programming language MATLAB for static analysis of truss, using Finite Element Method has been studied as 'Cost of the structure' being crucial factor, depends upon the mass of structure. Mass is directly relative to the material consumed by the skeleton of the structure.*

*- Mr. Sujit Tare*

### *Achievements*

*Department of Civil Engineering students secured the winning position at Amalthea IIT - Gandhinagar and proved their **COMPETITIVE SPIRIT, INTEGRITY AND WILL TO WIN**. Their determination, dedication, hard work and perfection was showcased in this event.*

*-Mr. Vineet Gupta*

## *Page 03*

*Mr. Vivek Todi, the speaker, shared his valuable knowledge on principles of Illumination design, basic concepts of lightning to understand the importance of shades and types of lights to be used depending upon the purpose to be served by the infrastructure.*

*-Lighting and Illumination design*

*It gives us immense pleasure to introduce this issue, motivating all the participants and the winners on Tantrotsav 2k18 and IIT - Gandhinagar. It is the proud moment for the department, when students get indulge in various activities, which adds feather in cap, to the departmental success.*

*-From HOD's Desk*

## From General Secretary of ACES

It was a blissful experience for us to work as team ACES incorporation with student council, to bring out a successful event 'Tantrotsav 2k18' under faculty guidance. So presenting this edition, highlighting the same. The event observed, encouragement to student, not only for their technical growth but also their overall development including management skills and leadership qualities.

“ *Altitude is the special highlight of this edition. It gives us the immense pleasure to congratulate the budding engineers who enthusiastically participated in the inter-collegiate technical festival "Tantrotsav". Also the immediate results of this seeds sown were observed at IIT - Gandhinagar, where our engineers shined as "Winners". So dedicating this edition to all the shining stars*

*-From Editor's Desk*

”

## Structural Optimization of Truss Using Finite Element Analysis

-by Mr. Sujit Tare



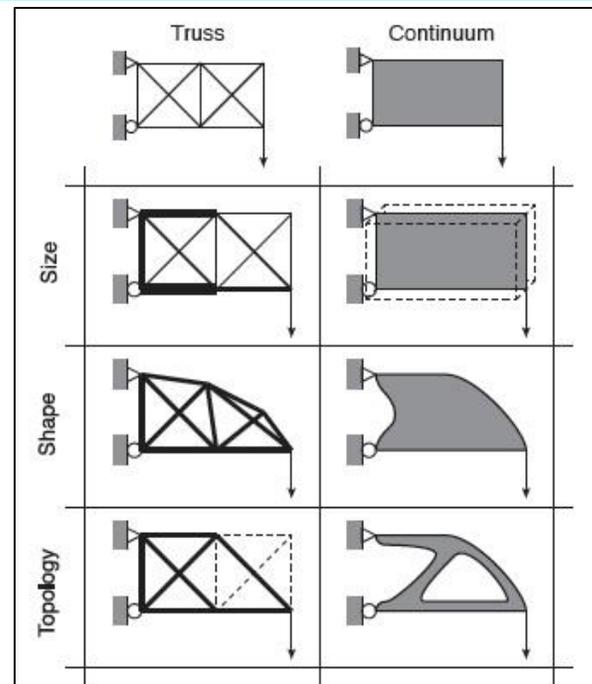
**About the Author:** Author has pursued his Graduation in Civil Engineering and Masters with Specialization in Structural Engineering.

Trusses are most commonly used structure in industrial buildings, warehouses, bridges, transmission tower etc. There are different types of trusses available for construction. The analysis and design of an economical and stable truss system for utilization in industrial buildings, storage rooms, bridges, warehouses, transmission towers etc. is necessary. The present study is done on static analysis and optimization of truss system to get optimal and economical configuration of truss. Total cost of the structure depends upon mass of the structure and mass is directly relative to the material consumed by the skeleton of the structure. This paper presents the use of programming language MATLAB for static analysis of truss structure using 'Finite Element Method' and the 'Topology Optimization' will be done based on the energy stored in the member. Static analysis of a 13 bar benchmark truss is done using MATLAB programming code and various results have been obtained. After interpretation of these results the safest and most economical system will be decided. The study has been extended to space truss for static analysis of transmission tower for different loading conditions.

### INTRODUCTION

Optimization of steel structures has a wide scope in Structural Engineering due to their own complication, reliability of results and its advantage to the industry. Weight optimization of truss structure plays a vital role in economic and sustainability considerations. The analysis part and optimization process is very complex and less reliable for manual calculation, hence now-a-days high-performance computing systems such as programming language or pre-programmed software is used to solve huge data of truss structure, obtaining the desired results with accuracy. The design of truss structure is based on the results of the size, topology, and geometry optimization, as shown in Fig. 1.

1. Size optimization deals with the provision of minimum cross-sectional area for members by assuming that the node connectivity and co-ordinates are fixed.
2. Topology optimization deals with the connectivity of member between nodes.
3. Geometry optimization deals with the determination of the optimum node co-ordinates by assuming that the topology of the truss structure is fixed.



### FINITE ELEMENT METHOD

Finite element method (FEM) is a numerical procedure for solving mathematical models numerically. FEM uses discretization (nodes and elements) to model the engineering system, i.e., subdivide the problem system into small components or pieces called elements and the elements are comprised of nodes. Approximations are introduced over each element to represent the behavior of the unknown variables and in finding out unknowns.

MATLAB is an integrated programming system, including graphical interfaces and a large number of specialized toolboxes for mathematical operations. In analysis type problems, basic variable or unknowns are displacements. This unknown is expressed as unknown field variable in terms of shape function. So, with the help of MATLAB linear programming, the mechanical model is converted into mathematical model and then shape function is used for each nodal point and unknowns are found out.

## MATLAB model of structure

A truss structure is programmed in MATLAB code with 6-Nodes, Load of 60 KN is applied at node 2 & 3, and Node 1 & 3 are fully constrained subjected to support conditions. MATLAB modelled structure is shown in Fig.

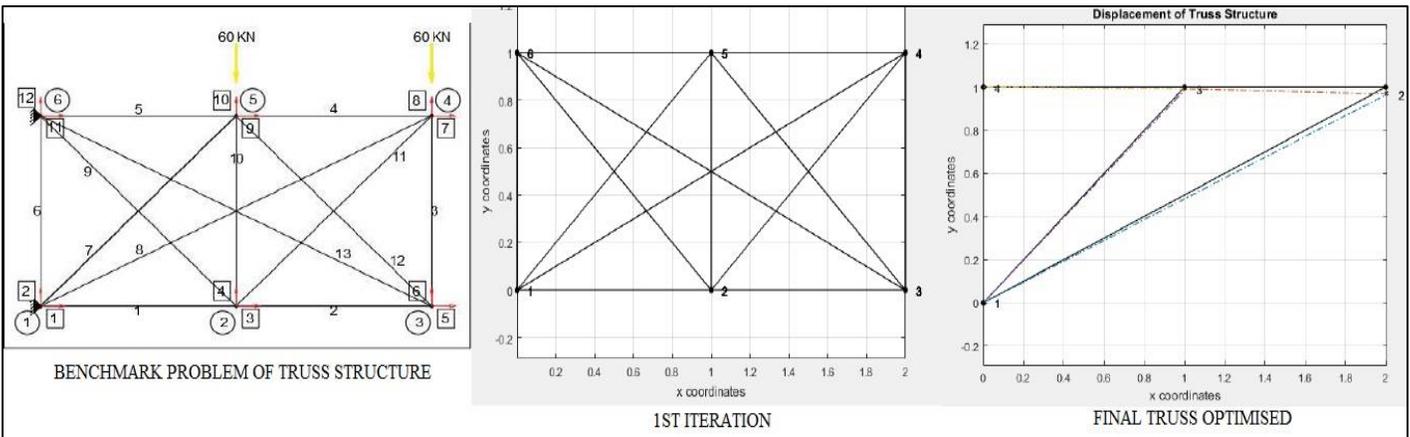
In Table. 1. Red colored boxes indicate that the strain energy stored in the member is very less as compared to other members, hence it contributes less in load transfer mechanism, which in turn is removed from structure. Sometimes the c/s area of member is also reduced so that the work done by the member is more and stores maximum energy.

Initial Member	Stress (N/mm <sup>2</sup> )	Axial Force (KN)	Energy (Joules)	Weight (Kg)	Node No	Deflection (mm)
1	-99.4119	-99.4119	24.7068	8.002	1	0
2	-42.8297	-42.8297	4.586	8.002	2	0
3	-24.2342	-24.2342	1.4682	8.002	3	-0.4971
4	53.7531	53.7531	7.2235	8.002	4	-1.0458
5	104.0053	104.0053	27.0427	8.002	5	-0.7112
6	0	0	0	8.002	6	-2.4619
7	-21.0254	-21.0254	1.1052	11.3166	7	0.7888
8	-63.0929	-63.0929	14.0739	17.8931	8	-2.5831
9	54.8769	54.8769	10.6472	11.3166	9	0.52
10	-25.1425	-25.1425	2.235	8.002	10	-1.151
11	7.9744	7.9744	0.2248	11.3166	11	0
12	-40.2209	-40.2209	9.0433	11.3166	12	0
13	41.5807	41.5807	9.6652	17.8931		
				Total		
				137.0666		

Table 2: 1st Iteration

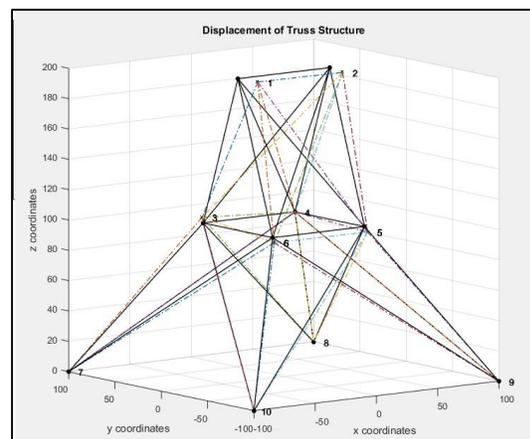
Member	Stress (N/mm <sup>2</sup> )	Axial Force (KN)	Energy (Joules)	Area(pro) (mm <sup>2</sup> )	Weight (Kg)	Node No	Deflection (mm)
1	227.2727	84.8528	68.1818	590.3219	10.5627	1	0
2	227.2727	84.8528	34.0909	528	4.2251	2	0
3	227.2727	84.8528	22.7273	792	6.3376	3	2.2727
4	-227.2727	-84.8528	68.1818	373.3524	4.2251	4	-10.2273
						5	1.1364
						6	-3.4091
						7	0
						8	0
				Total	25.3505		

Table 1: Final Iteration



## Conclusion:

From the above iterations performed on the benchmark truss, reduction of number of members and c/s area of the existing members is found to be reduced. Reduction in c/s area results in less consumption of construction material to be used, which in turn reduces the total dead weight of the structure. From the above methodology used for optimization, materials used are stressed to full capacity, resulting in material saving. The programming language developed can be used to solve larger complex structures with accuracy and quicker results as compared to manual methods.



In case of space trusses, the DOF available at each node is 3 which results in larger size of matrix and it is very complicated task to solve it manually. So, in this study program is developed using Finite Element Analysis in MATLAB for analysis of space truss. This program is able to analyze the space truss with 'n' number of member and boundary conditions.

## Seminar on “Lighting and Illumination Design”

### **Introduction:**

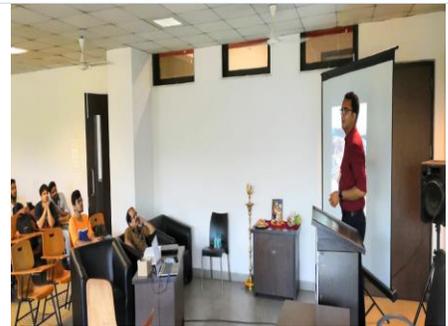
Seminar on ‘Lighting and Illumination Design’ was organized by the ACES, Department of Civil Engineering in ‘Universal College of Engineering’ on 23<sup>rd</sup> September, 2018. This Seminar was organized third year student.

**Objective:** To understand the principles of Illumination design, basic concepts of lighting and Modern lighting

### **About Session:**

The speaker, Mr. Vivek O. Todi, currently General Manager of NEWMAT India Pvt Ltd (A lighting & Architectural solutions provider) conducted this expert lecture. He discussed the basic concepts involved in the field of Lighting. Starting from the discovery of the first electric bulb to latest most efficient lighting systems available today all was covered elegantly. The speaker shared his experiences about lighting principles and the general misconceptions and assumptions by the people and the stake holders involving with the lighting industry.

The concepts of modern lighting in stores, offices, healthcare, education institutes etc. were covered with practical applications and experiences about the executed work for the same in field by the speaker. The involvement of the students in the lecture was noteworthy. The knowledge and interest of the students in the subject has enhanced through this lecture. .



## Site Visit at “Gorai Transfer Station”.

On 19th October 2018, Department of Civil Engineering had arranged the site visit to Gorai Dump Yard, Gorai 3, Borivali, Mumbai, 400092. The site visit was arranged for Final year students. There were about 65 students. The visit was guided by Ms. Shilpa Patil and Ms. Swapnali Onkar. Main purpose of this visit is to be familiar with the process of dumping and transfer of waste collected from different region. It was a great attempt, to know how Gorai dumping ground which is now converted into transfer station, and how a dumping ground is made into a park and students also came to know about the upcoming projects going to happen on the site. Students also got familiar with the processes like Relocation & Reformation of existing waste, covering of reformed slopes & plain area with liner system, Liner system comprises of Geo-Textile liner, HDPE, Landscaping, Surface water drainage for channelling the storm water, Installation of Landfill Gas (LFG) collection, etc.

Gorai Project was dedicated to Mumbai city on 18th August 2009 at the hands of then Hon. Minister, MoUD, GoI, Shri. Dr. Jaipal Reddy. Project is successfully registered under Clean Development Mechanism (CDM) of United Nations Framework Convention on Climate Change (UNFCCC) on 10th February 2010. This project has served the city with following benefits:

- Market value of property in the area increased resulting in increases in property tax collection to MCGM
- Fishermen’s income increased because of better marine environment
- Mangroves got rejuvenated resulting in healthy biodiversity in this region
- 19 Hectare of green lung added to the City of Mumbai.
- Green House Gases (GHG) emission stopped resulting in reducing carbon foot prints in the city



## Achievements...

It is the 3<sup>rd</sup> consecutive time that students of Department of Civil Engineering had won the winning position at Amalthea IIT - Gandhinagar and proved their **COMPETITIVE SPIRIT, INTEGRITY AND WILL TO WIN**. Amalthea '18 a technical festival was hosted on 20<sup>th</sup> -21<sup>st</sup> October, 2018 at IIT- Gandhinagar. The students from civil department participated in an event named SEISMISM, where the students have to create an earthquake resistant G + 6 floor building model by using Candy sticks and fevicol adhesive. About 38 teams from various institution had participated in this event and it is our privilege that our students had won all the winning positions and a cash prize of Rs. 15,000. Their determination, dedication, hard work and perfection was showcased in this event. The details of the participants are:

### Winners

- 1) Jaydeep Pansuriya
- 2) Parth Parmar
- 3) Sayani Paul
- 4) Rohit Patel

### 1<sup>st</sup> Runner-Up

- 1) Karan Raul
- 2) Shubham Singh
- 3) Tushar Borade
- 4) Ashok Gadave
- 5) Jayant Rokade

### We Believe

**"TROPHIES ARE WON AT PRACTICE, YOU JUST PICK IT UP AT COMPETITIONS"**

We at Universal College of Engineering had taken this event as an opportunity for students to enhance, practice and impart their knowledge and abilities. A Mock event was created where all interested students were taught about the subject, trained to analyze the structures in different software, check their efficiency and practice to create these models. The students were not only motivated but also provided with the financial sponsorship for the event.

Winner and Runner up in Amalthea IIT Gandhinagar...



## Altitude... Tantrotsav 2k18...

We, ACES, Department of Civil Engineering, UCOE, congratulating the winners and all the participants, who enthusiastically participated in the inter-collegiate technical festival "Tantrotsav".

### CE 01 - Urbania

Design and Develop a town by knowledge of Urban Planning

#### Winner-

Saurabh Saramble  
Vihar Raut  
Praful Rahate  
Priyanka Patil  
Vivek Prajapati

#### 1st Runner Up-

Jinal Padhiar  
Pooja Madi  
Nidhish Mehra  
Cristina Dmello

#### 2<sup>nd</sup> Runner Up-

Raj Parekh  
Dhiren Parekh  
Jay Panchal

### CE 02- Bridge it

Design a Bridge using Popsicle Sticks to carry heavy loads

#### Winner-

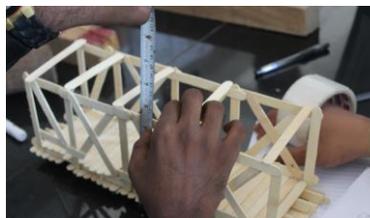
Drashan Mange  
Nayan Chavda

#### 1st Runner Up-

Ankit Bhoir  
Yash Patil  
Jayesh  
Mukadam

#### 2st Runner Up-

Mitali Raut  
Rahul Patel  
Amit Yadav  
Sakshi Dubey



### CE 03 - Rotofare

Design and Build the Roller Coaster, where coaster ( Ball Bearing) is riding under the action of gravity

#### Winner-

Dilesh Solanki  
Mehul Bhagat  
Rishabh Trivedi  
Dhruval Suriya  
Dhaval Tank

#### 1st Runner Up-

Abhinav Ashara  
Forum Panchal  
Suriel Gupte  
Ratik Chavan

#### 2<sup>nd</sup> Runner Up

Jatin Bhuta  
Sameep Mhatre  
Yash Patil  
Yash Deolekar  
Ankit Bhoir  
Jayesh Mukadam

Contd...

#### CE 04 – Master Builder

**Design and Build a structure which has maximum stability against toppling**

<b>Winner-</b>	Poras Mehta Dhruv Jadhav Hardik Jadhav Rishi Desai Mayur Patil
<b>1st Runner Up-</b>	Tarangan Patil Priyal Vyas Shefali Desai Jhanvi Shimati
<b>2nd Runner Up</b>	Rishabh Trivedi Dhaval Tank Dilesh Solanki Mehul Bhagat Dhruval Suriya

#### CE 06- Scavenger Hunt

**Solve the Puzzle at various stages and reach to the Treasure**

#### CE 07- Balloon Pyramid

**Use Balloons to build a pyramid of paper cups**



Rotofare



Prize Distribution

#### CE 05 – Make Way

**Design a road connecting Chinchoti with Ghodbandar road by considering all aspects of Geometric Design of road**

<b>Winner-</b>	Harsh Doshi Tushar Chotaliya Yash Parikh
<b>1st Runner Up</b>	Omkar Surve Aniket Sawant Akshara Pillai Adarsh Singh Bhavik Tank
<b>2nd Runner Up</b>	Varad Gadgil Bhavin Chauhan Dharmik Ahir Akhil Kamble Amit Bharati

#### CE 08 – Dumb Charades/Techtalk

**A simple game of Dump Charades but with a little twist**

<b>Winner-</b>	Kareena Mukadam Praneeth Hegde Yash Devlikar Kareena Mukadam
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*Before reviewing the event, I would like to express my deepest gratitude to all staff members for trusting me with an event as big and technical as Tantrotsav. I would like to thank all the staff members of the other departments for lending their unconditional support to us. Needless to say, organising and handling this fest posed as challenge to me and my team, but it is with great pride that I can say that all went well. It also gives me pleasure in announcing the statistics of the event as a total of 280 groups, we set history by gathering maximum students support and participation. I would like to conclude by thanking each and every one who played a role in making Tantrotsav the success that it was and we look forward to presenting you with more such events.*

*-Mr. Ayush Kottari,  
General Secretary, ACES*

➤ Team ACES and Tantrotsav

*Tantrotsav is an event where all Engineering minds meet to compete which enhance their practical knowledge. It is uniquely different from any other college fest of the kind, with a strong motive and purpose. It aims to foster scientific temper, innovation, inquisition and creativity among the masses and to enlighten young minds through technology.*

*-Mr. Miraj  
Thaker, Joint Treasurer*

#### CE 09 – Maze Runner

**Reach from one end to the other end of a glow maze in a dark room**

<b>Winner-</b>	Aqueel Payal
<b>1st Runner Up-</b>	Arsh Gopani Ninad Jadhav
<b>2nd Runner Up</b>	Bhavin Chauhan Dharmik Ahir Manav Dharia Bhavin Chauhan

#### CE 10 – Modular Origami

**Build any structure in the given volume using modules made from Origami**

<b>Winner-</b>	Sureil Gupte Jatin Bhuta Abhinav Ashara Ratik Chavan Forum Panchal
<b>1st Runner Up-</b>	Govinda Chavan Keval Gandhi Sumit Gupta Kishan Das

