Journal Of Electrical Engineering And Advanced Technology

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Aims and Scope

Journal of Electrical Engineering and Advanced Technology is a journal that publishes original research papers in the fields of Electrical Engineering and Advanced Technology and in related disciplines. Areas included (but not limited to) are electronics and communications engineering, electric energy, automation, control and instrumentation, computer and information technology, and the electrical engineering aspects of building services and aerospace engineering, Journal publishes research articles and reviews within the whole field of electrical and electronic engineering, new teaching methods, curriculum design, assessment, validation and the impact of new technologies and it will continue to provide information on the latest trends and developments in this ever-expanding subject.

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Contents

A Survey Report on Isolation Techniques for Printed MIMO Antenna Systems

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A B S T R A C T

Wireless communication has become an essential part of our day to day life. Printed antennas are leading technology for these wireless systems. With the ever growing demand of higher data rate and larger channel capacity, Multiple Input Multiple Output (MIMO) technology find its place among various existing wireless technologies. Like other technologies this also has limitations due to system size and space related issues. Fortunately researchers are successfully find way to address these problems. Lot of intense research work is done and lot more is yet to be done. This survey is mainly aimed towards summarizing various isolation techniques used in MIMO systems. To the best of author's knowledge this kind surveys are very few and more need to be carried out. The focus of present survey is on categorization of various isolation techniques.

Index Terms: Channel Capacity, Decoupling Structures, Isolation, Multiple Input Multiple Output, Mutual Coupling, Wireless Communication.

1. INTRODUCTION:

Although Ultra Wide Band (UWB) systems are deployed and providing high data rate transmission, they are not sufficient for upcoming demand of higher channel capacity. The wireless standards such as existing 4G and upcoming 5G demand even more on channel capacity. Since transmission bandwidth and power levels cannot be increased within present international spectrum allocation scenario which is below 6GHz. That is why a new technology which can promise higher data rate transmission within existing bandwidths is highly in demand. Apart from that, existing UWB systems also suffer from multipath fading effects. Let in a wireless system we have M transmitters and N receiver antennas. Ref. [1] gives the general channel capacity equation as,

$$C = BW \log_2 \left(det \left(I_N + \frac{P_T}{\sigma^2} HH^H \right) \right) \qquad (1)$$

Where, C stands for channel capacity, BW is channel bandwidth, PT represents equally distributed input power among the element, while σ2 represents noise power and IN and H are symbols for an NxN

identity matrix and a complex channel matrix respectively. It is clear from this equation that increase in band width or Signal to Noise Ratio (SNR) will result in increased channel capacity 'C', but as we have mentioned that the spectrum and power levels which are practically being used cannot be increased as is set by various government agencies as well as various leading operators, which leaves only two options viz. increasing M and/or N to have higher channel capacity C. This is the motivating force behind development of MIMO technology. MIMO stands for Multiple Input Multiple Output system and is based on using multiple antennas to transmit the signal and multiple antennas at receiver side, with different fading characteristics [2]. This is inspired by an old concept of spatial multiplexing, which began in late 1950s, intended to increase capacity of telephone relay links.

Initially it used cross polarized antennas, among them one was horizontally polarized and another one was vertically polarized. This was the natural way of providing isolation and placing antennas $\lambda/2$ distance apart was also the effective one. But devices are getting smaller and smaller day by day and so space available for antenna elements is also shrinking which makes it impractical to provide enough separation between antenna elements to reduce mutual coupling. So it is needed to carry out a survey on various decoupling techniques used for MIMO technologies. The author found that there are negligible surveys on this topic, available in open literature. This survey is an effort towards the fulfillment of the demand.

II. ISOLATION IMPROVEMENT CONCEPT AND TECHNIQUES

Most of the printed antennas have the drawback of propagation of surface waves in antenna substrate [3]. These surface waves cause mutual coupling which has serious effect on radiation efficiency and channel capacity of individual antenna element as well as on MIMO configuration of antennas [4]. The most simple yet powerful way to mitigate mutual coupling is to place antenna elements with a sufficient inter element separation i.e. $>\lambda/2$, but this may lead to increase in grating lobes and if we keep the separation less than that, it will cause coupling. One more technique for the same is to place antennas perpendicular to each other, this is an effective method for linearly polarized antennas but this also need space. Placing individual antenna elements with a larger separation can only be done at transmitter side because a sufficient space is available there, but same is not the case at receiver side as most of them are mobile devices. So various techniques are reported to reduce mutual coupling as well as separation between antennas in MIMO system which are summarized in subsequent sections.

A. Decoupling Structures

Decoupling Structures are used to cancel mutual coupling by providing a negative coupling at the input ports of the individual antenna elements of MIMO antenna system. Decoupling structures can be

constructed using lumped elements or distributed one or using both of them. Decoupling networks usually have large sizes for lower frequencies due to the size of transmission line needed. Decoupling structures made of lumped elements realized using hybrid coupler resolves the problem space availability for lower frequency (i.e. <1GHz) in [5]. For Ultra Wide Band, a floating parasitic digitated decoupling network provides isolation about 20dB over a wide bandwidth [6]. Investigation on other structures is summarized in the table 2A.

TABLE 2A

Ref.	Freq. (GHz)	Isolation	Remark
[7]	7.5	< -58dB	Uses directional couplers.
[8]	2.45 and 5.25	< -20dB	Makes use of strip Monopole.
[9]	0.704-0.960 and 1.71-2.17	-10dB and -15dB	Provide tunable isolation bandwidth of 260MHz.

B. Defected ground structures

Coupling between adjacent antenna elements which caused by ground currents can be reduced by applying modifications to the ground plane [10]. Ground plane modifications such as cutting slits or other shapes, work as band stop filter for the coupling fields generated by ground currents. [11], [12], [13], and [14]. Most commonly the defected ground structures are placed beneath the transmission line which reduces the effect of electromagnetic fields around the defect. These structures make the ground complicated. Summary of different MIMO systems using defected ground structures is given in table 2B.

TABLE 2B

Ref.	Freq. (GHz)	Isolation	Remark
[15]	1.8	< -10dB	H shaped DGS, compact but not efficient enough.
[16]	3.35 and 4.5	-33 and -27 dB	Co centered circular split ring slots, good spatial diversity.
[17]	2.7 and 3.95	-18 and -21 dB	Cutting slits in ground, compact design.

C. Parasitic elements

These are the elements which are placed near antenna elements or between two elements, in case of MIMO antenna systems to minimize coupling. They also create opposite coupling fields between antenna elements to counter the coupling fields between antennas. Parasitic elements are not actually connected to antenna elements, they are placed near them. They are advantageous as they can be designed for various purposes such as to control bandwidth along with decoupling [18]. They can be composed of resonators or stubs with both floating and/or shorted arrangements. Some of the works in MIMO utilizing parasitic elements are listed in Table 2C.

TABLE 2C

Ref.	Freq. (GHz)	Isolation	Remark
[19]	3.1 to 10	>23dB	Used impedance resonators with ground modifications
[20]	4.5	-37.2dB	Used rectangular parasitic tape so it avoids etching slots on ground plane.
[21]	6	-36dB	Good isolation and diversity gain achieved using slots in EBG.

D. Neutralization lines

Neutralization lines are also effective in providing isolation. In neutralization technique current taken from one element is fed to other element with reversed phase using a transmission line of suitable length to minimize the coupled currents with second element [22]. The complication in this technique is, to select a proper location of maximum current to be picked up and to manage proper length of

neutralization line to reverse the phase of that current with in limited space available. It takes very detailed analysis of current distribution and associated phase on antenna. Also these line are suitable for narrow band antennas, they are not as effective for wide bandwidth. Neutralization lines are not always straight lines; they can sometimes look like decoupling structures and can act as both a decoupling network and a neutralization line. Some latest implementation work is summarized here in the table 2D.

TABLE 2D

Ref.	Freq. (GHz)	Isolation	Remark
[23]	1.7-2.76	< -15dB	Diversity gain near 10dB
[24]	2.4	< -19dB	Compact
[25]	3.1 to 5	< -22dB	Bandwidth and efficiency slightly reduced

E. Met materials

Metamaterials are artificial material composed of tiny unit cells made of ordinary material and arranged in specific manner to synthesize negative material properties such as negative permittivity or negative permeability or both, depending on need. They may be planar such as Electromagnetic Band Gap (EBG) material or non planar. They can also be classified as Epsilon Negative (ENG), Mu Negative (MNG) or Double Negative (DNG) [26]. Lot of work has been done in the field of metamaterials due to their capabilities.

There exists a band gap in the frequency response of metamaterial which acts as band stop filter, which can eliminate the coupling between elements of MIMO system and so they are considered a candidate for isolation enhancement. Some of the considerable work in listed in table 2E.

TABLE 2E

Ref.	Freq. (GHz)	Isolation	Remark
[27]	1 to 2	> -25dB	Upto 18% size reduction
[28]	2.4	> -37dB	Open slot split ring resonator (OSSRR) used
[29]	5.2	-56dB	Compact and high performance but Increase in substrate loss

III. CONCLUSION

Based on the survey conducted for MIMO isolation techniques we conclude that metamaterial not only provide high isolation but also serves better for antenna size reduction. Other good methods are decoupling networks and defected ground structures as compared to neutralization line or parasitic elements. We tried to summarize as much as possible isolation techniques used in MIMO systems. This is not still over and the field has much more to be discovered. There are lot of the techniques which are not categorized yet such as joining ports or providing polarization diversity by simply tilting the beam of antenna, ground plane modifications are also effective and lot of other techniques. We started our talk by basic concept of MIMO and summarized various techniques. This is a little effort and lot more need to do in this area of isolation enhancement.

REFERENCES

1. A. Goldsmith, Wireless Communications. Cambridge, MA: Cambridge Univ. Press, 2005.

2. Li Liu, S. W. Cheung and T.I. Yuk, "Compact MIMO Antenna for Portable Devices in UWB Applications," IEEE Trans. Antenna Propagat., Vol. 61, No. 8, August2013, p. 4257-4264.

3. M. Toolabi, R.A. Sadeghzadeh and M.N. Moghadasi, "Compact Meandered-Shape Electromagnetic Bandgap Structure Using in a Microstrip Array Antenna Application," Micro. And Optic. Techno. Letters, Vol. 58, No. 9, September 2016, p. 2084-2088.

4. Xu Yang, Ying Liu, Yun-xue Xu and Shu-xi Gong, "Isolation Enhancement in Patch Antenna Array with Fractal UC-EBG Structure and Cross Slot,"(to be published) IEEE Antennas and Wireless Propag. Letters, DOI 10.1109/LAWP.2017.2703170.

5. Bhatti R.A., Yi S, Park S-O, "Compact Antenna Array with Port Decoupling for LTE-Standardized Mobile Phones," IEEE Antennas and Wireless Propag. Letters. 2009, Vol. 8, No. 3, p. 143.

6. Khan M.S., Capobianco A. D., Nijam A.I., Shoib I., Autizi E. and Shafique M.F., "Compact Ultra-Wideband Diversity Antenna with a Floating Parasitic Digitated Decoupling Structure," IET Microw., Antenna and Propag. 2014; 8(10):747-53.

7. Xia R, Qu S, Jiang Q, Li P and Nie Z., "An Efficient Decoupling Feeding Network for Two Element Microstrip Antenna Array," IEEE Trans. On Anten. And Wireless Propag. Letters. 2015; 14:871-4.

8. Lin K.C., Wu C.H., Lai C.H. and Ma T.G., "Novel Dual Band Decoupling Network for two Element closely spaced Array using Synthesized Microstrip lines," IEEE Trans. On Antennas and Propag., 2012, Vol. 60, No. 11, p. 5118-5146.

9. Chen W.J.and Lin H.H., "LTE700/WWAN MIMO Antenna System Integrated with Decoupling Structure for Isolation Improvement," Antenna and Propag. Society International Symposium (APSURSI); 2014; p. 689-90.

10. *Islam M.T.and Alam M.S., "Compact EBG Structure for alleviating Mutual Coupling between Patch antenna Array Elements," Progress in Electromagnetics Research, 2013, Vol. 137, p. 425-438.*

11. *Yu-Ting W. and Chu Q.X., "Dual Band Multiple Input Multiple Output Antenna with slitted Ground," Microw. Antennas and Propag., 2014, Vol. 8, No. 13, p. 1007-1013.*

12. *Chiu C.Y., Cheng C.H., Murch R.D. and Rowell C.R., "Reduction of Mutual Coupling between closely packed Antenna Elements," IEEE Trans. on Antenna and Propag. 2007. Vol. 55, No. 6, p. 1732-1740.*

13. *Ghosh C.K. and Parui S.K., "Reduction of Cross Polar Radiation of a dual trace Omni Directional Microstrip Antenna Array by using Dumbbell-Shaped Resonator," Microw. And Optic.Tech. Letters, 2014. Vol. 56, No. 1, p. 141-146.*

14. *Salehi M., Motevasselian A, Tavakoli A. and Heidari T., "Mutual Coupling Reduction of Microstrip Antennas using Defected ground Structure," International Conference on Comm. Systems (ICCS), 2006. P. 1-5.*

15. *Islam M.T. and Alam M.S., "Compact EBG Structure for Alleviating Mutual Coupling between Patch Antenna Array Elements," Prog. In Electromag. Research, 2013, 137:425-438.*

16. *Sung Y.J., Kim M. and Kim M.S., "Harmonics Reduction with Defected Ground Structure for a Microstrip Patch Antenna," IEEE Antenna and Wireless Propag. Letters, 2003. 2:111-3.*

17. *Yu Y. et al. "Dual Frequency Two-Element Antenna Array with Suppressed Mutual Coupling," Internat. Journal of Antennas and Propag. 2014, 1-6.*

18. *M.S. Sharawi, "Printed Multiband MIMO Antenna Systems and their Performance metrics," IEEE Antennas and Propag. Mag., 2013. (55):218-232.*

19. *Li Y., Wem X.L., Chengyuan L. and T. Jiang, "Two UWB-MIMO Antennas with high Isolation using Sleeve Coupled Stepped Impedance Resonators," Antenna and Propag. (APCAP), 2012; 21-2.*

20. *H. Wang, D.G. Feng and X.L. Wang, "Mutual Coupling Reduction between two Microstrip Patch Antennas by using the Parasitic Elements," Microwave Conference, 2008. P. 1-4.*

21. *S. Ghosh, T.N. Tran and T. Li-Ngoc, "Dual-Layer EBG-based Miniaturized Multi-Element Antenna for MIMO Systems," IEEE Trans. on Antenna and Propag., 2014. Vol. 62, No. 8, p. 3985-3997.*

22. *Y.T. Wu and Q.X. Chu, "Dual-Band Multiple Input Multiple Output Antenna with slitted Ground," Microwaves, Antennas and Propag. 2014. Vol. 8, No. 13, p. 10007-1013.*

23. *Y. Wang and Z. Dun, "A Wideband Printed Dual-Antenna System with a novel neutralization line for Mobile Terminals," Antenas and Wireless propag. Letters, 2013. Vol. 12, p. 1428-1431.*

24. *S.W. Su, C.T. Lee and F.S. Chang, "Printed MIMO Antenna System using Neutralization Line Technique for Wireless USB-dongle Applications," IEEE Transactions on Antenna and Propag. 2012. Vol. 60, No. 2, p. 456-459.*

25. S. Zhang and G. Pedersen, "Mutual Coupling Reduction for UWB MIMO Antennas with a Wideband Neutralization Line," IEEE Antennas and Wireless Propag. Letters, 2015. Vol. 15, p. 166-175.

26. M.U. Khan, M.S. Sharawi and R. Mitra,"Microstrip Patch Antenna Miniaturization Techniques: A Review," IET Microwaves, Antennas And Propagation, 2015. Vol. 9, p. 913-922.

27. Y.H. Ren, "A Wideband Dual Polarized Printed Antenna based on CSRR, " IEEE Antennas and Wireless Propag. Letters, 2015. Vol. 14, p. 410-413.

28. D.S. Chandu, S.S. Karthikeyan and K.V.P. Kumar, "Reduction of Mutual Coupling in a Two Element Patch Antenna Array using sub-wavelength Resonators," 21st National Conference on Communications (NCC); 2015.

29. A. Habashi, J. Nourinia and C. Ghobadi, "Mutual Coupling Reduction Between very Closely Spaced Patch Antennas using Low Profile Folded SRR," IEEE Antennas and wireless Propag. Letters, 2011. Vol. 10, p. 862-867.

Application of Discrete Event Simulation Towards Production Improvement

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A B S T R A C T

Reenactment showing is an unprecedented mechanical assembly for exploring and improving groundbreaking methods. particularly, while numerical upgrade of complex structures ends up infeasible, and remembering that genuine preliminaries inside generous systems is undeniably too much extreme, dreary, or unsafe, diversion transforms into a ground-breaking gadget. In genuine widespread amassing, reenactment lets in the portrayal, appraisal and streamlining of making systems and collaborations methods. Entertainment stipends to make virtual models of creation structures so you can examine system qualities and improve their presentation. The propelled model now not best draws in customers to run tests and think about how conceivable it is that conditions without irritating a present collecting machine. This paper depicts how Discrete occasion propagation may be used to evaluate throughput, alleviate bottlenecks, reduce aesthetic manifestations in-way, quality usage of machines and besides incredible effect of as a rule execution parameters, which join line remaining weight, breakdowns, latent and fix time and novel essential all things considered execution segments. all together that bother can be without burdens examined, separated and changed inward a petite time.

Keywords—Discrete event simulation, productivity, utilization, optimization

1. INTRODUCTION:

Discrete-occasion Simulation (DES) is a system appropriate for the examination of introduction structures and works all round performance. The appearance shape may be displayed in an enjoyment circumstance to analyze the unique possibilities for illuminating the system both to guess the effect of changes to a gift device similarly as a mechanical assembly to envision execution of recent structures. Generally talking the profitability of the advent structures should be up to date because of excessive hypothesis costs and rich progression of the 2 matters and methodology. The bolstered eagerness for lean introduction has finely tuned a necessity for masses dynamically capable collecting structures which in like manner offers to new devices as Simulation. Advent structures of today be orchestrated to be attempted to encourage age in a terrific greater swiftly time-to-publicize pace. An unusual nation of computerization and amplified pastimes in new introduction systems first-rate little little bit of the excessive complete use. The benefit can be succeeded at the same time as an association impels its

operational incentive thru perceived, dismembered and balanced the parameters, as an example, throughput, breakdowns, device imperativeness use and line converting. An sizable little bit of the Indian producers are up 'til now slacking in achieving first rate introduction sufficiency while seemed in any other case with reference to Japan, the us, Germany and china. Searching at the introduction overhaul in the plant is tough for a human due to lacking statistics approximately device and its parameters. Creation ought to reliably relies upon upon customers and their delight. To make primary and unassuming creates can repeat without a time and pleasures the consumer to achieve an exceptional motion in the globalization.

II. SOFTWARE PROGRAM OF SIMULATION

Reenactment as a technique, has getting used even extra routinely for one-of-a-kind type of creation systems. Plenteous examinations have being issuing foundation one in all a type employments of proliferation which, as a education license to propel the arrival capacity to choose vital and usable choices as for brand spanking new choice sustenance device on a everyday reason. Everywhere in the Discrete event Simulation can be used in the exam and shape of an age gadget. DES as an accommodating technique for buying prepared administrators and specialists in how the unquestionable form capabilities, helping the outcomes of modifications in device factors and progressing new techniques approximately managerial associations for regard blanketed comfort of the tool. In the examination and check of a modern or proposed creation shape the multiplication has verified to be an obvious technique. In some unspecified time in the future of the layout set up for the execution of a creation shape, reenactment incline to software program on device and material handling requirements. The yield of the propagation contemplates guides the structure of the device want and the degree of system appear. Proliferation can be applied in like way to check numerous manipulate and dispatching methodologies. In this perspective, there is a important for structure routine gauge in vicinity of system frustration valuation after the hitches scene. The extra hitches may be foreseen, the better the shiver of passing propitious and employable game plans. This should be viable as an instance through the aggregate of entertainment aptitudes with the existing age orchestrating and manage tool.

Technology can extraordinary piece which goals due to sources controls might be past due or if mass is to be had to finish the advent plans. Thusly the multiplication version fund to picks with regards to an operational device to affect the unquestionable awareness for the introduction shape.

III. LITERATURE SURVEY

Diversions [3] give different inquiries inside age to be spoken without the inadequacies of attempting various things with a genuine gathering contraption. work bothers tended to are the requirement for and the proportion of equipment and staff, normal execution examination, and assessment of operational techniques [7]. An entertainment examination of the limit of social event needing set-up times in basic leadership at the solicitation dispatch measurement of a remarkable job needing to be done controlled extraordinarily make float store [1]. They demonstrated that the zone framework, which has been expectedly gotten a handle on in exercise and in most by far of the examinations disseminating with shape-subordinate set-up times, does now not reliably pass on the lovely results. Generation has been effectively executed in a ton of research related to collecting machine association and action. PC proliferation offers stunning equipment for imagining, making light of, and examining the components of amassing structures [2]. because of its worry and hugeness, the help designation burden has been deliberate commonly and great courses are available inside the composition. In gathering machine ampleness of cyclic time and restore time has evaluated [5]. Setup time has no effect on the by and large earth shattering machine (OEE), advancement in the significance of line and crucial weight prompts decay OEE. changing over client demands and wants, relatively to mechanical enhancements, are the signs of amusements for associations that need to intensely react to adjustments in the market. Conveying new item into the market, or improving gift ones, calls for changes no longer simply inside the human sources or budgetary regions, yet next to at the volume of the creation and flow techniques. using the reenactment systems, creators can affirm that the purposeful amassing solicitations can be executed on time [4, 2].

IV. METHODLOGY

"Procedure length is delineated as the time it takes to finish a framework". It joins the time from even as a head starts offevolved a course until the canvases is set up to be passed on. It contains procedure time, setup time and repairing time. plan of data the usage of procedure Time gauge (MTM). dedication of the issue occurred in contemporary creation line that empowers you to accommodating to look at so you should do progression. appraisal of the showing and diversion for present bother and help to examine game plan adequately.

V. CASE STUDY

A. Data Collection

Data collection has done by using work study and work measurement using Method Time Measurement (MTM). Table I, data samples comprises process time, setup time and cycle time. Failure of machines has neglected since no

machines will able to give 100% efficiency, when the efficiency has reformed, especially when efficiency was decreased, the machines were blocked. Cycle time calculated using Equation 1.

$$\text{cycle time} = \frac{\sum_{i=1}^{n} \text{Job completion time}}{\text{Total number of jobs}}$$

(1)

Takt Time calculation:

Working shift per day = 3

Working hours per shift = 8 hours

Available time per shift = 480 minutes

Tea break per shift = 1 breaks * 10 minutes = 10 minutes

Lunch break per shift = 20 minutes

Down time per shift = 10 minutes

Networking time per shift = [available time-(breaks +break down)]

= 480-40

= 440 minutes

= 26400 seconds

Networking time per day = 79200 seconds

Customer demand per day = 300 pieces

Takt time = Net working time per day/ Customer demand per day

= 79200/300

Takt time = 264 seconds

Table I: Data samples of each machines

Descriptions	Process time (min)	Setup time (min)	Cycle time (min)
Facing & centering	2.00	0.30	2.50
Turning	2.40	0.25	3.05
Keyway Milling	1.00	0.40	2.00
Rough CAM Milling	2.45	0.30	3.45
Hardening 1	5.30	0.20	6.10

Hardening2	5.30	0.20	6.10
Tempering	3.00	3.00	7.15
Check for Bending	1.15	0.10	1.28
OD Grinding	2.00	0.30	2.46
Finish CAM Grinding	2.30	0.30	3.14
ODGrinding1	4.00	0.30	4.45
Slotting & Reaming	2.00	0.30	2.40
MP Inspection	1.20	0.20	1.55
Drilling	5.00	0.20	5.32
Final Inspection	2.00	0.10	2.23

Table II: Energy consumption in different processes

Resource	Working	Set-up	Waiting	Blocked
Drilling	97.19	0.03	2.79	0
.RoughCAMMilling	90.15	0.04	0.58	9.23
Turning	89.94	0.03	0.2	9.83
Hardening1	88.85	0.03	0.84	10.28
Hardening2	88.66	0.03	1.06	10.26
ODGrinding1	83.47	0.04	2.1	14.39
Tempering	70.21	0	1.3	28.48
Facingcentering	68.4	0.04	0.08	31.48
FinishCAMGrinding	53.39	0.04	2.52	44.05
ODGrinding	43.66	0.04	4.83	51.47
SlottingReaming	39.87	0.04	6.51	53.58
FinalInspection	38.77	0.01	61.22	0
KeywayMilling	33.25	0.05	21.54	45.15
CheckforBending	28.27	0.01	12.44	59.28
MPInspection	27.21	0.03	13.69	59.07
.Source	0	0	0	100
Drain	0	0	100	0

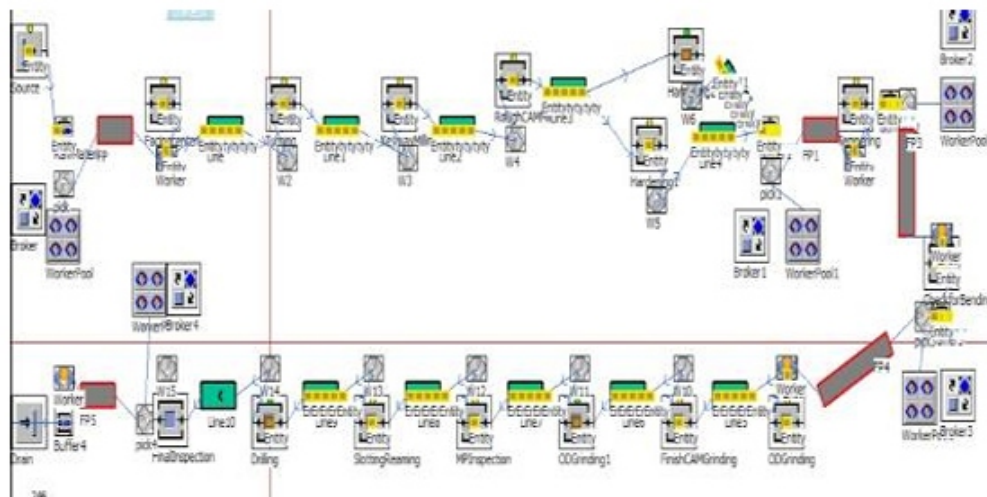## B. 2D & 3D Production Line Visualization
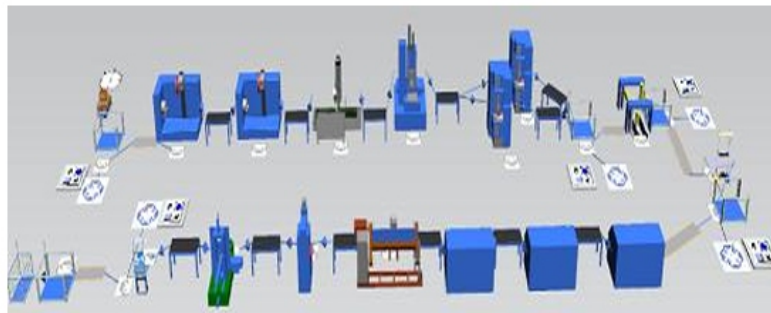

Figure 1: 2D model visualization

Figure 1: 2D model visualization

From the above Fig 1&2 indicates the clear visualization of the production line which will be help full for space accuracy, layout shape and machine assembled space, space for worker movement and space for storages (source and Drain). Layout models can be leveraged directly in visualization, material low and discrete event simulation programs, they offer considerable time savings.

VI. RESULTS AND DISCUSSIONS

A. Workstations (Machines) Utilization. Fig. 3 suggests the usage of every tool within the production line for the facts samples shows in table I. We located that for the current manufacturing line running performance has now not as plenty because the delight, about 60% of the machines are ready, 86% of the machines are overloaded and, forty% of the machines every (waiting & overloaded) in the manufacturing line. therefore in which the most machines are blocked or waiting, the operators in idle and in overloaded operators have burden.
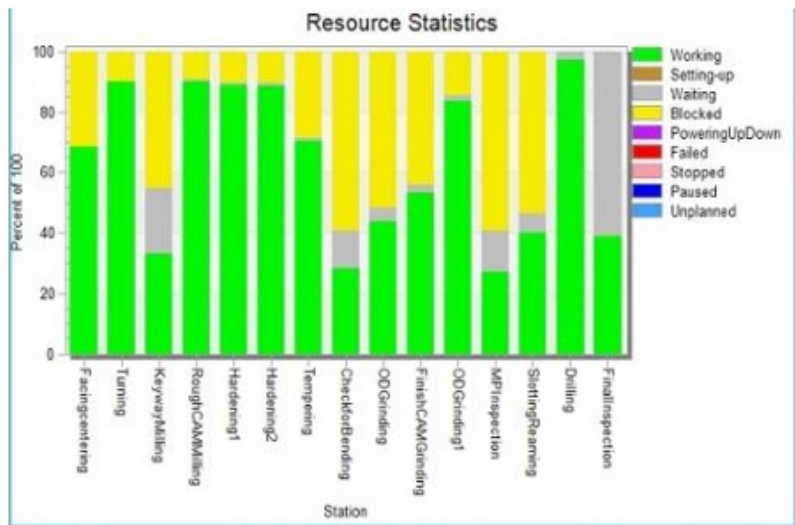
Figure 3: Utilization of Machines in Production Line
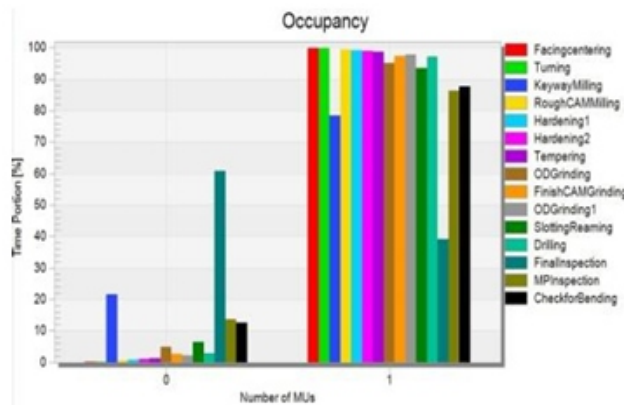
B. Occupancy of Workstations.

Figure 4: Utilization of Machine Occupancy in Production Line

$$\text{Occupancy rate} = \frac{\Sigma\ \text{Handle time}}{\Sigma\ \text{Handle time} + \text{Available time}} \quad (2)$$

Occupancy directly ensures the productivity, higher the % of occupancy, higher will the % of productivity. Fig 4. Shows the poor utilization of entities (product) with respect to the time. Calculation of occupancy using Equation (2).Initially occupancy percentage was currently very low only final inspection has around 65%, gradually it was increased after number of entities moved complete production line. Hence constant material flow throughout the production line increase the occupancy

percentage of the workstations.
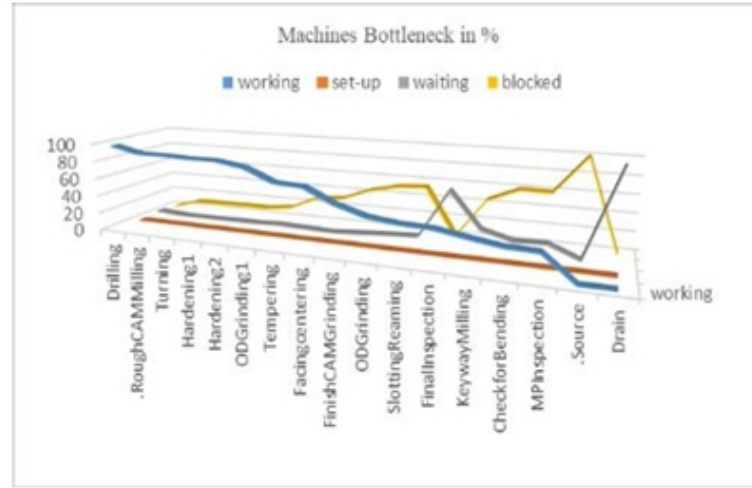
C. Bottleneck Analysis

Figure 5: Bottleneck of each workstation

Bottleneck analysis will help to identify where exactly the load has more, stumpy and balanced. So that we can take action immediately. Fig. 5 shows initially it was smooth, after few entities there was unbalanced due to variation in the Process time and setup time of machines so that some worker are overloaded some are idle.
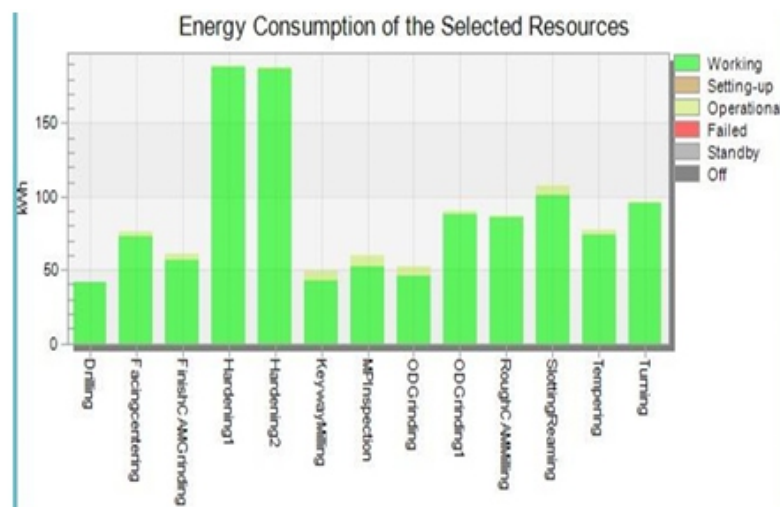
D. Energy consumption and power input
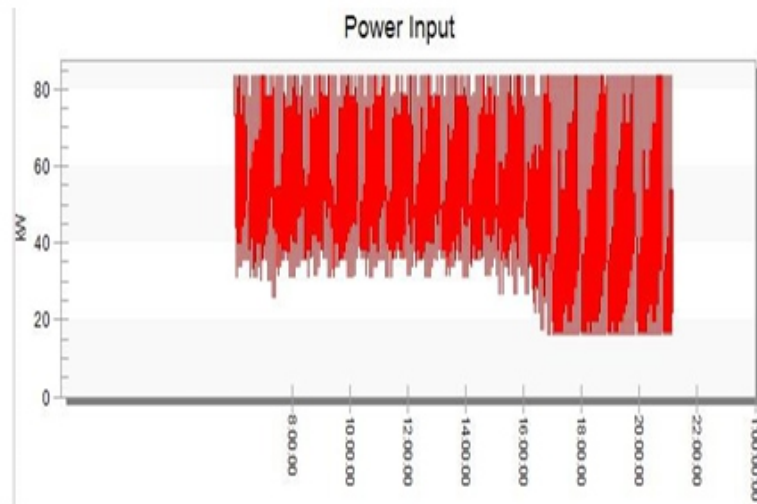

Figure 6: Energy consumption by each workstation

Figure 7: Variation of power input with respect to time

$$Pc = Pi + cv \quad (3)$$

Pc is the power [KW] consumed by the process, Pi is the power [KW] consumed by all machine modules for a Machine working at 0 load (powered machined which is not cutting), C is the specific energy requirement in lowering / mm operations. V is the fabric elimination charge (MRR). The electricity intake for the machining manner is depending on the energy ate up and specific power in the slicing operations. Fig 7. Illustrate growth in the paintings hours will increase the input electricity for the machines, we also can look at upto 16 hours electricity has regular, after that it have become extended about 20%. Fig 6. Indicates energy intake is more at hardening workstations because of excessive cycle time look at to different workstations. Subsequently energy consumption may be greater at immoderate procedure time and setup time.

E. Throughput Analysis.

Table III: Details of Throughput data

Name	Mean Life Time	Throughput	Throughput per Hour	Production	Transport	Storage	Value added	Portion
Entity	5:46:48.3137	246	11.63	15.82%	40.86%	43.32%	10.67%	

$$TH = I_n / T_i \quad (4)$$

Where TH= Throughput of production line

In = Inventory used over a period of time

Ti = Total time required. It includes PT, IT, MT, QT

Throughput analysis shows the overall production rate.

We observe there is very low production rate in the current production line. Value added is only 10.67%

due to improper line balance, variation in the process and setup time in different workstations. Failure percentage also more (red). About 246 entities can be produce per day so that approximately 12 entities per hour. We can improve production rate by improving total time i.e. process time (PT), Inventory time (IT), move time (MT) and Queue time (QT).

VII. CONCLUSION

In clothing adventures now and then it's far hard to catch the fundamental part territories and practices, which can be used to progress the contemporary device and circumstance inside the methodology. giving over pointless mind blowing at low charge in petite lead times are the focal troubles experienced with the benefit of the garments creators. Discrete event generation help to keep running over fundamental issues in collecting line, it prescribes in which completely the non-accuse stole leave of noteworthy and minor issues, with the goal that dispose of the intolerance conditions. shape this investigation we discovered setup and way time leads tremendous uniqueness in the age contraption. diminishing the setup time has fundamental effect at the guide utilization, PC station inhabitance, imperativeness and data essentialness. Bottleneck ended up being more in the collecting line because of unsuitable undertaking of work. In CNC machines, it changed into totally hard to dispose of the bottleneck on account of two or three constrained parameters. lessening setup time and nonrate procured methodology time we will diminish control use at some stage in device, which allows in making benefits. generally 20% of the pad may be lessened with the accommodating resource of cutting down bottleneck in each machine. shape throughput assessment we found best 10.67% charge introduced inside the amassing line. limit utilize approximately forty three.32%, transportation forty.86% and creation use least complex 15.81%. With this procedure length throughput become 11.sixty three concerning hour.

REFERENCES

1. Fernandes, N. O., and Carmo-Silva, S. "Solicitation dispatch in an extraordinary job needing to be done controlled buoy shop with aggregation set up set-up events". by and large magazine of amassing mulls over, 40 9(8), pp. 2443-2454, 2011.

2. Seleim, An., Azab, An., and AlGeddawy, T. "Reenactment techniques for Changeable amassing". 45th Cirp appear on gathering systems, 3, pp.179-184, 2012.

3. Roriz, C., Nunes, E., and Sousa, S. "programming of Lean collecting musings and equipment for fine headway of gathering methodologies in a Carton association". Procedia delivering, 11, pp. 1069-1076, 2017.

4. Krenczyk, D, Olender, M. "manufacturing masterminding and control the utilization of bleeding edge amusement systems". by and large journal of current amassing age. Vol 6, pp.38forty three, 2014

5. Paprocka , W Kempa , OK Kalinowski and C Grabowik, "Estimation of standard instrument ampleness the usage of generation program" IOP Conf. game plan: substances imaginative information and Engineering pp.ninety five-one zero one, 2015

6. Asif Rashid and Benny Tjahjono "accomplishing creating Excellence through the mix of association structures and Simulation" age organizing and direct, vol 27, issue 10, pp.837-852 2016

7. Szu-Yung David Wu, Richard A. Wysk, "A result of discrete occasion propagation to on-line control and anticipating versatile creation" overall magazine of amassing research, (12), pp. 1603-1623, 2016

Use of Microprocessor, Microcontroller & Soc Development Platforms in Automobile Engineering Courses

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A B S T R A C T

Automotive industry no longer will be a mechanical thing. Electrical & Electronics plays a predominant role in automotive. Current and future automotive technology relies on smart, self-driving cars which intern employs the smart sensors, processors, actuators. Open source and proprietary development boards enhance learning skills of students. Availability of Microprocessor, Microcontroller & SoC development platforms are rich. Usability and user friendliness are two main parameters. Students consider Cost, Power usage and Data rate as critical factors. Online Resources like Blogs, engineering community forums provide good support for learning and using microcontrollers. Studies found that students felt comfortable with practice based learning. This study will look at the attitude of students in choosing Microprocessor, Microcontroller & SoC development platforms for Automobile engineering courses.

Key Words: Electronics in Automobiles, SoC based Automotive system development, Automotive ECUs

1. INTRODUCTION:

Advancement of Automotives and vehicular technology paved a path for employment of Electronic devices such as sensors, processors and actuators, technology scaling of electronics has further supported automotive technology in terms of reduction in size, cost, and power consumption. Employment of electronics in vehicle has improved safety, reliability, and comfort in every aspects. Basic parts of an automobile are,

• Basic structure – Frame, suspension, Axle, Wheel

• Power Unit – Engine

• Transmission system – Gearbox, clutch, Drive shaft

• Controls – Brake, Steering

• Auxiliaries – Head lamp, Indication lamps

• Super structure – Body

World's first automobile "motorwagen" was purely mechanical machine. Employment of electrical into automobile started with headlamps and spark plugs for gasoline engines. Automotive technology started scaling up with the automation in power train systems[1]. Now a day's electronics plays a predominant role in automotives[2]. Modern car has average number of 80 ECUs in it [3]. Each ECU is assigned for a specific job. All the ECUs comes under any of the following category of systems,

• Power train system

• Chassis system,

• Infotainment,

• Body electronics,

• Advanced Driver Assistance system (ADAS)

As for as the power generation is concerned, engine is dedicated for that, purely Fuel engines were used. Now a day's hybrid engines ie, power generation is done using fuel and electric power. Future technology will have a fuel cells and electric power generation units. Power train system includes both power generation and transmission. Engine is the source of power generation system. Power generation system includes fuel system, carburettor, ignition system, exhaust system, cooling & lubrications. The power generated in an engine should be efficiently delivered to the wheels. Engine cannot be directly coupled with wheels, there comes the need for transmission systems. The transmission system includes Gearbox, clutch, Drive shaft. The ECUs under power train system will assist all power generation in an engine and transmission to the wheels. Chassis system includes Frame, suspension, Axle, Wheel. There are number of systems and subsystems are designed as ECUs. This is an era for the development of infotainment system for automotives. Number of Infotainment system like Satellite based navigation, Audio systems, Human Machine Interface, connected vehicles are commonly used Infotainment systems now a days. Body electronics[23] deals with Head and rear lamps, Controls of door and windows and other passenger comfort related subsystems. Advanced Driver Assistance system (ADAS) eases the driver to drive the vehicle. A modern car has number of ADAS like Adaptive cruise control, Automatic headlamp control[10], Hill assist, Electronic Scalability control,..etc., The automotives are getting smarter and employment of electronic systems are keep on increasing, so the scope of Microprocessor, Microcontroller & SoC development platforms are high in automotive applications.

II. PRACTICE BASED LEARNING

Traditional teacher centric lecturing approach will result a student with good knowledge. but in order to solve the real world engineering problems, The students should be equipped with required skill sets. The skills can be obtained only by doing. Studies found that practice based learning is an active

learning tool, which will trigger the student to get involved into the process or activity[4][5]. Course projects were introduced to make a students to do some hands on experiments, learn by their own and through their peers. Peer learning has a great impact on the students[6][7]. The knowledge management studies insists that the understand ability of students is high in practice based learning. The things will remain for a long in minds if they have experimented and experienced the things[8][9]. Use of Microprocessors, Microcontrollers & SoC will make the students to do the hand on experiments of ECUs and that will improve their skill. Group experiments and projects will allow the students to learn from peers.[21][22] Involvements in team activity will prove the psychomotor as well.

III. EMBEDDED SYSTEM AND USE OF MICROPROCESSORS, MICROCONTROLLERS IN AUTOMOTIVE

Embedded system is a microprocessor or microcontroller based computer system which is dedicated to one or more functions. All the ECUs inside a car are basically an embedded systems. Using microprocessor and microcontroller platforms, the students can create their own prototypes for Power train system, Chassis system, Infotainment, Body electronics, Advanced Driver Assistance system (ADAS).

Riofrio et al used Arduino for teaching Introductory Mechatronics [11], they found that the outcome was great when compared to conventional purely lecture oriented teaching method. [12][13][14][15] used open source or proprietary board for various engineering courses and claiming that the use of those boards improved the involvement of students in learning activity. Initially all the ECUs were purely embedded systems. Now a days, Most of the systems or ECU needs an Internet connectivity. This is because of the paradigm shift from normal Embedded systems to IoT systems. So In the case if normal embedded systems, simple microcontroller boards were used. In the case of IoT based systems, Microcontrollers with Ethernet shield or WIFI shield is being used[19][20]. There is also availability of boards with Ethernet and WIFI on board. Wide variety of microprocessor/microcontroller board are available. The choice of boards can be based on the application, Cost or easy to use. Table 1 shows the list of Microcontroller boards (but not limited to) which can be used for teaching automobile engineering courses. Smart systems are equipped with Artificial Intelligence, these kinds of systems will employ DSP processors. Connectivity of the systems also matters[17].

S.No	Name of the Board	Manufacturer
1.	Edision	Intel
2.	Arduino Uno	Arduino
3.	STM32F4	STMicroelectronics
4.	SAM V71	Atmel
5.	Beaglebone	Arrow Development Tools
6.	DragonBoard 410c	Arrow Development Tools
7.	MSP430	Texas Instruments
8.	CC3200	Texas Instruments
9.	FRDM-KL43Z	Freescale Semiconductor

Table 1 : List of Microcontroller boards suitable for Automobile engineering courses.
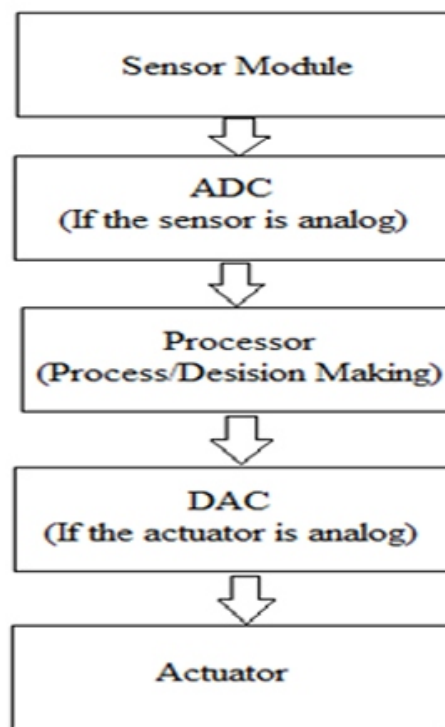

Fig 1 : Signal Flow Diagram of typical embedded system

Data conversion : Most of the sensors are analog because all the natural signals are analog in nature. Processors and controllers process only digital signal. some of the actuators need analog input but the processors/controllers will produce only digital input. So the conversion is needed between them. The Fig:01 depicts the signal flow of a typical embedded system. The inputs will be taken from sensor module. If the sensed input is a analog value, hten we have to convert into Digital value, for this ADC(Analog to Digital Convertor) can be used. Then the digital input will be given to the processor. The processor will be assigned with some process or some conditions for decision making. Based on

the instructions to the processor, the actuation will be done. DAC (Digital to Analog Convertor) can be used for Digital to Analog Conversion.

IV. SYSTEM ON CHIP (SOC) DESIGN

In a System on Board Design, The systems will be designed using microprocessor and microcontroller. The supportive devices for the system will be placed on the board itself. As the number of systems increases, It is difficult to accommodate more number of boards for each and every systems. This constraint push the new design paradigm call System on Chip (SoC) Design. In SoC, A whole system can be designed on a single chip. This design approach reduces the size, cost and power consumption of the system[18]. Fig 2 shows the SoC design view. In SoC processing system is surrounded with programmable logic. Processing system is nothing but a microprocessor, programmable logic is FPGA.

The embedded application can be ported on processing system, If the application needs any resource like memory, then there is no need to add a memory integrated circuit as like in the System on Board design. We can directly design that particular memory on the programmable logic. There are number of Soft IPs also available the ease of designers to directly use them in SoC.
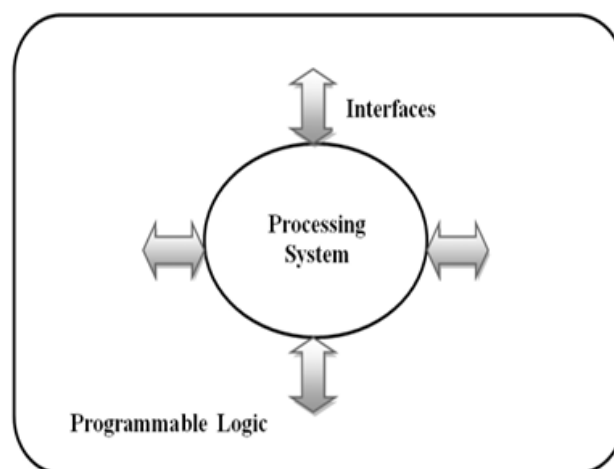

Fig 2 : SoC View

Some of the systems or ECUs in automotive applications are highly sensitive. Those kind of system needs high degree of security and the output from the system should be precision. Complexity of designing such systems are high. Example : system is Diesel Engine Management System(DEMS). DEMS is used to manage all the engine related functions like coordination of fuel injection with respect to accelerator pedal pleasure, CAM and Crank shaft timing, Engine diagnosis, Warnings., etc,

There are dedicated boards like Infineon Tricore are used for Diesel Engine Management System. Kang et al, Developed a SoC based Diesel Engine Management System. The high precision or highly securable systems can be designed using System on Chip approach.Table 2 shows the List of SoC platforms suitable for Automobile engineering courses. The choice of boards can be based on the application, Cost or easy to use.

S.No	Name of the Board	Manufacturer
1.	Zynq 7000	Xylinx
2.	Zybo	Xylinx
3.	PSOC IV	Cypress
4.	Cyclone	Altera
5.	DE 1, 2	Altera
6.	Atom	Intel
7.	STM32F4	STMicroelectronics

Table 2 : List of SoC platforms suitable for Automobile engineering courses.

A.: Result and analysis

Since it is hard real time systems, Verification It is an important. 75% SoC design time is spent for verification. The functionality and timing of the system should be verified before its fabrication. Any malfunction or timing violation in the system leads to big problem. The SoC verification can be done using UVM methodologies.

V. CONCLUSION

In this paper we disscussed the use of Microprocessor, Microcontroller & SoC development platforms in Automobile engineering courses. Industry needs engineers with adequate skill set to do their job. The skill of the student can be improved by practice based learning. Automotives are getting electrified now a days and future trend in automobiles will be based more on celectronics. Knowledge and skill of electronic devices such as sensors, processors, controllers, actualors is mandatory for automobile engineers. Teaching the automobile engineering couses with the use of Microprossors, Microcontrollers and SoC platforms will make the student to understand the systems and its design. Practice based learning with these platforms will master their skills in designing Automotive applications.

REFERENCES

1. W. Fleming, "Forty-year review of automotive electronics: A unique source of historical information on automotive electronics," IEEE Veh. Technol. Mag., vol. 10, no. 3, pp. 8090, 2015.

2. J. A. Domínguez-Machuca, M. Sacristán-Díaz, and M. J. Álvarez Gil, "Adopting and implementing advanced manufacturing technology: New data on key factors from the aeronautical industry," Int. J. Prod. Res., vol. 42, no. 16, pp. 3183–3202, Aug. 15, 2004.

3. Wikipedia contributors. (2018, May 17). Engine control unit. In Wikipedia, The Free Encyclopedia. Retrieved 15:38, May 31, 2018, from https://en.wikipedia.org/w/index.php?title=Engine_control_unit&oldid=841696655

4. Bain, K., & Zimmerman, J. (2009). Understanding great teaching. Peer Review, 11(2), 9–12.

5. Bradbury, H., & Reason, P. (2008). Handbook of action research: Participative inquiry and practice (2 ed.). London: Sage Publications.

6. Bringle, R. G., Clayton, P. H., & Price, M. (2009). Partnerships in service learning and civic engagement. Partnerships: A Journal of Service-Learning and Civic Engagement, 1(1), 1–20.

7. Brown, T., & Wyatt, J. (2010). Design thinking for social innovation. Stanford Social Innovation Review (Winter), 32, 23–30.

8. Steels, L., "Corporate knowledge management", Proc. ISMICK'93, Compiègne, France, 1993, 9-30.

9. O'Leary, D.E., "Entreprise Knowledge Management", Computer, 31, 3,1998, 54-61.

10. Navaneethakrishnan R, Santhanalakshmi M, Ramalatha Marimuthu, Kumaresan A, "ADAS Headlamp for improved visibility," Int. J. Pure Appl. Math., vol. 119, no. 12, pp. 12541–12548, 2018.

11. J. A. Riofrio and S. G. Northrup, "Teaching undergraduate introductory course to mechatronics in the mechanical engineering curriculum using Arduino," in ASEE Annual Conference and Exposition, Conference Proceedings, Atlanta, GA, 2013.

12. R. Chancharoen, A. Sripakagorn, and K. Maneeratana, "An Arduino kit for learning mechatronics and its scalability in semester projects," in Proceedings of IEEE International Conference on Teaching, Assessment and Learning for Engineering: Learning for the Future Now, TALE 2014, Wellington, New Zealand, 2015, pp. 505 – 510.

13. L. Abrams, J. W. Altschuld, B. W. Lilly, and D. A. Mendelsohn, "Introduction to mechanical engineering: A course in progress," in ASEE Annual Conference and Exposition, Conference Proceedings, San Antonio, TX, 2012.

14. M. Turner and T. R. Cooley, "A low cost and flexible open source inverted pendulum for feedback control laboratory courses," in ASEE Annual Conference and Exposition, Conference Proceedings, Seattle, WA, 2015.

15. G. W. Recktenwald and D. E. Hall, "Using Arduino as a platform for programming, design and measurement in a freshman engineering course," in ASEE Annual Conference and Exposition, Conference Proceedings, Vancouver, BC, Canada, 2011.

16. Q. Kang, Z. Xie, Y. Liu, and M. Zhou, "A Fuel Injection Control SoC for Diesel Engine Management System Control Logic and State," pp. 969–972, 2017. DOI: 10.1109/ASICON.2017.8252639

17. David S, Navaneethakrishnan R "Energy Consumption And Load Balancing Compared With VANET and MANET," Int. J. Pure Appl. Math., vol. 116, no. 12, pp. 257–265, 2017.

18. R. Navaneethakrishnan, S. Rekha, and S. Bhavani, "A Novel Paradigm to Eliminate Timing Violations using AHL," Indian J. Sci. Technol., vol. 9, no. 44, 2016.

19. S. Shivkumar, A. Kavitha, J.N. Swaminathan and R. Navaneethakrishnan, 2016. General Self-Organizing TreeBased Energy Balance Routing Protocol with Clustering for Wireless Sensor Network. Asian Journal of Information Technology, 15: 5067-5074. DOI: 10.3923/ajit.2016.5067.5074

20. Pavithra P, Kumaresan A, Navaneethakrishnan R "Automation for Surveillance & Live Streaming," Int. J. Pure Appl. Math., vol. 117, no. 21, pp. 911–914, 2017.

21. K. Pradeep Mohan Kumar,M.Saravanan and M.Aramuthan, "Hybrid Network Intrusion Detection System Based on GANN Models", International Journal of Pure and Applied Mathematics,Volume-116,No-11,2017,31-39.

22. Manikanda Prasath. K, Balaji M," A Green Supply Chain Agility Index For E- Commerce Business: An Indian Perspective Using Interpretive Structural Modeling", Journal of Advanced Research in Dynamical and Control Systems, Vol. 9. Sp– 6 / 2017,pp1913-1925.

23. Priya Gupta, Surendra Sutar,"Multiple Targets Detection And Tracking System For Location Prediction", International Journal of Innovations in Scientific and Engineering Research (IJISER),Vol-1,Issue-3,MAR 2014/103,pp127-130.

Seismic Retrofitting of Reinforced Concrete Beams with Baslt Fibre Mat

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A B S T R A C T

Earthquake is one of the major disaster which is responsible for massive destruction of human life and materials. To reduce the impact of earthquake, all the important structures need to be effectively strengthened for improving the performance and life of the structure. RC structures often face modifications and improvement of their performance during their service life. This paper represents the change of Reinforced concrete structural components which are found to exhibit distress because of earthquake loading. In this research work, basalt fiber mat is used to wrap around the beam specimen and determining the load carrying capacity of the specimen.

Keywords: Retrofitting, basalt fiber mat, ultimate load, ductility ratio

1. INTRODUCTION:

Retrofitting is the categorized as the modification of building or existing building. Retrofitting can be achieved by incorporating the techniques which will reduce the impact of earthquake on building so that the building will meet the seismic demands for load carrying members or as a whole. Some of the structural parameters include strength, stiffness & ductility ratio can be improved by this retrofitting technique. Increasing the properties and member load carrying capacity, earthquake responses can be minimized effectively.

Retrofitting technique can be adapted to all the structural works which entirely depends on the following factors which includes, material availability, technology used, and cost, duration of work, functional and aesthetic requirements. This technique can be either local retrofit or global retrofit and that is based on the effectiveness on usage of structural members. Structural level retrofit can be defined as the simplest method to increase the seismic resistance of new as well as existing buildings. Jacketing construction is one of the preferred methods of seismic retrofitting which can be applied by External confinement of fiber reinforced polymers of Basalt fiber reinforced composite.

II. LITERATURE REVIEW

[1] Song et al. (2004) determined the mechanical properties of Steel Fiber Reinforced Concrete (SFRC) for different volume fractions of (0.5%, 1.0%,1.5%, and 2.0%). Test results shows that

maximum compressive strength of the SFRC gained at 1.5% volume fraction will be 15.3% improvement; whereas split tensile strength and modulus of rupture of SFRC enhanced by increasing the fiber volume fraction, attaining 98.3% and 126.6% enhancements, respectively, at 2.0% fiber.

[2] Shahawy et al. (1996) analyzed the flexural behavior of RC beams with epoxy bonded Carbon Fiber Reinforced Polymer (CFRP) laminates. The observation of the study included crack load (first), cracking behavior (flexure & shear), deflections, service loads, and ultimate strength and failure patterns. A theoretical analysis was also carried out to compare with experimental results.

[3] Abdel-Jaber et al. (2007) looked into the behavior of shear strengthening of RC beams using Carbon Fiber Reinforced Polymer (CFRP). The investigation was carried out to determine the shear behavior of RC beams strengthened by CFRP strips in different configurations using epoxy adhesives. Two types of CFRP materials, namely pultruded and pregpag materials were used and a comparative study was made between the results was carried out for finding the best configuration for strengthening. It was observed that application of CFRP in the shear spans increased the strength between 19%and 56%. Also, the greater increase in shear strength was achieved by providing sheets over the entire depth of the shear span.

[4] Giuseppe Oliveto And Massimo Marletta (2005) evaluated the traditional and innovative methods of seismic retrofitting. Importance will be given for reducing the stiffness of the building which is vulnerable to earthquake. For reducing the stiffness, seismic base isolation method was adopted. Sway of the building can be minimized by such method and also the minimal drift is produced. From the observation, it was concluded that, elastomeric bearings used in base isolation are very effective in reducing the energy absorption characteristics of the building.

III. MATERIALS USED:

Cement

Cement is used is OPC 53 grade. It is conformed to IS: 12269 were used in the present study.

Table 1 Cement properties

S.No	Properties of Cement	Attained from standard tests
1	Specific gravity of OPC 53 Grade cement	3.15
2	Initial setting time	45 minutes
3	Final setting time	386 minutes
4	Standard consistency (%)	30
5	Fineness (%)	4

Fine aggregate:

River sand is completely replaced by M-Sand. The properties of M-Sand were tested and it is shown in the table 2.

Table 2 M-Sand properties

S.No	Properties of M-Sand	Attained from standard tests
1	Specific gravity	3.15
2	Fineness modulus	3.0
3	Water absorption (%)	0.5

Coarse Aggregate:

20mm coarse aggregate is used in this project work as per IS: 2386-1963 (I & II). Table 3 shows the coarse aggregate properties.

Table 3 M-Sand properties

S.No	Properties of Coarse aggregate	Attained from standard tests
1	Specific gravity	2.72
2	Water absorption (%)	0.5
3	Fineness modulus	7.3
4	Particle shape	Angular

Water: potable water is used and the water should be free from impurities

Super plasticizer:

Super plasticizer is a high range water reducing admixture in which Conplast SP430 is in this research work. To improve the flow characteristics, i.e. workability and to achieve a better slump, chemical admixture is used in small percentage.

Epoxy resin and hardener:

It is used as a bonding agent between the basal fiber mat and concrete surface. Thermosetting resin is used in this work.

Basalt fiber

Basalt fiber mat is a fabric woven type mat which is derived from the igneous rock type basal rock. It is one of the new polymers which have its better thermal resistance. It has high tensile strength 2800-4800MPa.
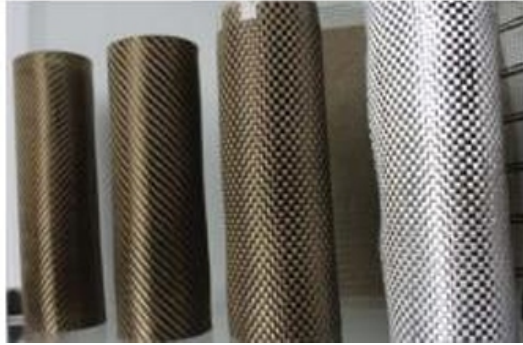
Fig 1 Basalt fiber

Reinforcement details:

The reinforcement of 3 specimens are four numbers of 8mm diameter were used for main reinforcement of 300mm spacing c/c, 2 no's of 8mm diameters were used for top reinforcement and 2 numbers of 12mm diameters were used for the bottom reinforcement of beam. The stirrups of 6mm dia and 30 mm c/c from the face of beam of 300mm c/c.

Casting and Curing:

The mould sides are oiled and it is free from absorbing the cement paste. The reinforcement cages are place inside the moulds with sides, top and bottom cover blocks. Concrete mixing is done in 3 layers and compacting using tamping rod. Test specimens were remolded at the end of 48 hours of casting.

Fig 2 Casting of Beam and surface finishing

Fig 3. Curing of Specimens

Control specimen

The beam size of 1500* 220mm reinforced with two numbers of 12mm diameter cast with M30 concrete is taken as control beam. Control beam is cured for 28days and tested under two point loads using loading frame. Loading is applied to the beam. In this case we took two beams. The beam of size same as the control beam.

The beams are braking at 40 kN using loading frame. Then the beams are chipping up to neutral axis from the bottom. The epoxy resin and hardener is taken as correct proportions and paste the chipping space of the beams. Then the basalt fiber mat single layer wrapping and double layer wrapping of beams separately. After two days the beams are tested. The initial crack occurred at 50 kN for single layer wrapping and the initial crack occurred at 40 kN for double layer wrapping. The failure is a compression failure.

Experimental Result

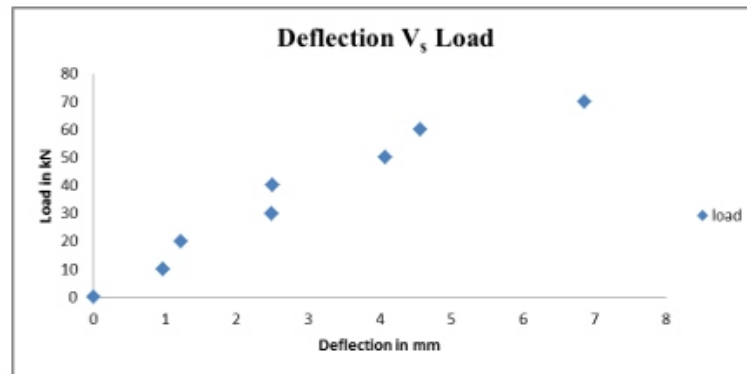| S. No	Load in kN	Deflection in mm			Strain	
		D1	D2	D3	Compression	Tension
1	0	0	0	0	0	0.00001
2	10	0	0.97	0.78	0	0.00001
3	20	1.84	1.20	1.89	0	0. 00001
4	30	2.42	2.32	2.55	0.00001	0.00001
5	40	2.65	2.25	2.92	0.00001	0.00002
6	50	4.00	4.01	3.45	0.00001	0.00002
7	60	4.12	4.75	4.25	0.00001	0.00002
8	70	6.12	6.56	7.36	0.000004	0.000024
Initial Crack = 40 kN						
Ultimate Crack = 70 kN						

Figure 4. Graph between Deflection and load

IV. CONCLUSION

1. The load carrying capacity (ultimate) of beam is increased 41.9% compared to control beam

2. Deflection of the beam is decreased by 8.24% in comparison with control specimen.

3. Initial crack of the beam is decreased 25% compared to control beam.

4. It can be concluded that basalt fiber can be used as a retrofitting material for structural elements.

5. It is planned to study the behavior of basalt mat fiber in reinforced concrete beam under cyclic loading.

6. Basalt fiber mat used for retrofitting of beam it reduces the crack width.

REFERENCES

1. Song P.S., Hwang S., Mechanical properties of high-strength steel fiber reinforced concrete, Construction and Building Materials 18, (2004),669-673.

2. Shahawy, MA, Arockiasamy, M, Beitelman, T &Sowrirajan, R 1996, 'Reinforced concrete rectangular beams strengthened with CFRP laminates', Composites: Part B Engineering, vol.27, no. 3-4, pp. 225-233.

3. Abdel-Jaber, MS, Anis, S, Shatanawi, Mu'tasim, S & AbdelJaber 2007,'Guidelines for shear strengthening of beams using carbon Fiber-Reinforced Polymer(FRP) plates', Jordan Journal of Civil Engineering,vol. 1, no. 4, pp. 327-335.

4. Giusepe Oliveto, Massimo Marleta, (2005), seismic retrofitting of reinforced concrete buildings using traditional and innovative techniques, ISET journal of earthquake technology, 42(2-3), pp 21-46.

A Broadband Metamaterial Absorber

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A B S T R A C T

This paper gives structure and standard execution of a broadband metamaterial protect at microwave frequencies.The unit cell of proposed structure combines of set-rectangular structure patches of copper put diagonally,at the most noteworthy purpose of the FR4 dielectric substrate and a steady ground plane of copper. The proposed shape demonstrates the broadband response of a maintenance exchange speed of two.7 GHz with more than 90 five% absorptivity degree starting from 6.nine GHz to nine.6 GHz.It shows wideband ingestion upto forty five dimensions scene edges underneath underhanded recurrence for each TE and TM polarizations.

Index Terms : Metamaterial,Absorption.

1. INTRODUCTION:

Metamaterial is phony substances that suggests odd electromagnetic wave (EM) characteristics that cannot be discovered in nature like poor refraction file, shielding conduct, radio wires, superlens, shields [1], and so forth at unique electromagnetic repeat. 'ideal metamaterial protect' had been proposed in 2008 with the aid of manner of Landy [1] seeing that than metamaterial shields have drawn noteworthy interests amongst various authorities. Because of its extremely-skinny thickness, lighter weight and prolonged sufficiency, these metamaterial shields are starting at now superseding the ordinary protections, which have the burdens of being massive and fragile. Metamaterial defend is an incidental form and comprise a unit mobile.In standard, a metamaterial defend carries regular 3 layers of the MDM (metallic-dielectric - steel systems) kind of direction of movement, that is in discontinuous case of unit mobile has been comprehensively utilized in various plans. The ones structures can manage their remarkable electromagnetic parameters to such a degree, that the facts impedance of the structure finally ends up being immovably planned with the free area impedance. In the meantime, in case the lossy dielectric substrate ingests the occasion wave definitely, with the aid of then this outcomes in about brotherly love digestion. Up till this factor, numerous protect structures were arranged indicating one-of-a-kind homes, as an instance, single-band [1], multi-band [5], statistics transmission up to date [4], broadband [2], polarization brutal [3] and significant-region ingestion [3] for numerous capability packages. In a part of the ones programs (like stealth

improvement, anechoic chamber), broadband protections are significantly endorsed, even as in numerous packages, for instance, radar go-component decline, electromagnetic impedance/electromagnetic likeness affirmation and radio repeat recognizing verification, multiband shields are frequently cherished.

II. DESIGN AND REENACTMENT OF THE PROPOSED SHAPE:

The top factor of view on the proposed form is showed up in determine 1.It well-knownshows a novel unit cellular which consists in rare manner involve metal patches set corner to nook backwards making rehash to each different.The patches appear to be set-sqaure circumstance of copper having conductivity of five.Eight x107 S/m with zero.035mm thickness. The bottom of the form is definitely of copper with thickness 0.035mm and segregated from top layer with a dielectric substrate of FR-4 (εr = 4.4 and tanδ = 0.02)of thickness 2mm. All of the additives of the unit mobile are improved as a=10mm, b=6mm, c=8.6mm, d=2.3mm, f=2mm, g=1.6mm,w=1mm.
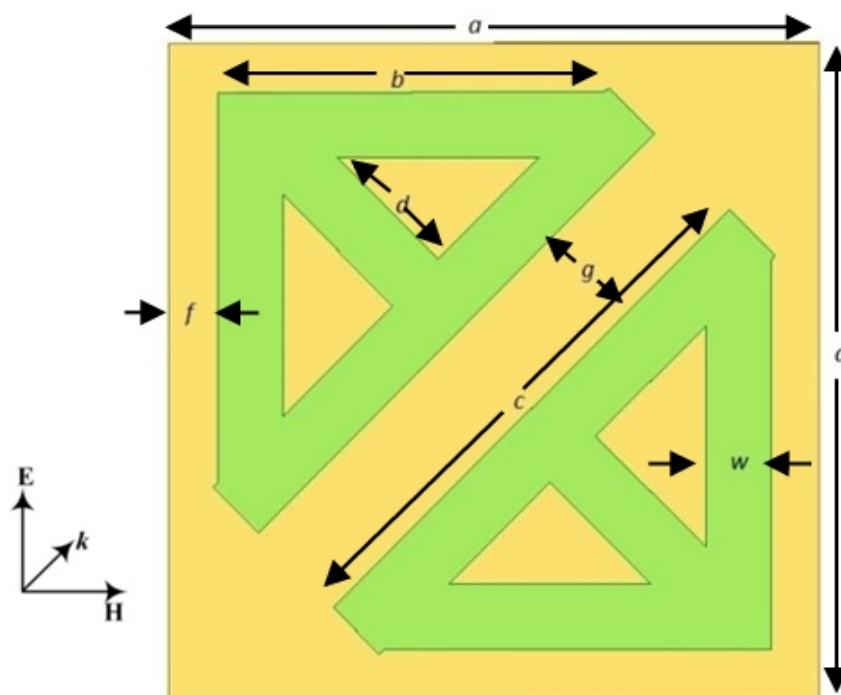
Figure.1 Unit cell of the proposed structure.

The absorbtion is excitedly related to the reflected photo and transmission and repeat of scene electromagnetic wave.a super metamaterial shield may be performed through constraining the reflected picture and transmission waves to get most noteworthy absorbtion.The transmission of 0 can be executed through using steel floor plane at the most insignificant of the structure, that is ordinarily thicker than the skin power of metal used on the assignment repeat. hence, when the EM waves are transmitted into the metamaterial protect, they will disappear because of the dielectric and metallic

hardships.

The absorbtion can be resolved through Eqn (1),wherein ω is repeat of operation,A(ω) is the absorption,R(ω) is the reflected picture and T(ω) is the transmission and S11(ω) and S21(ω) are the relating S parameters.right legitimately here Z0 is free zone impedance and Z(ω) is unit cell impedance.

$$A(\omega) = 1 - R(\omega) - T(\omega)$$
$$A(\omega) = 1 - |S_{11}(\omega)|^2 - |S_{21}(\omega)|^2 \qquad (1)$$

The reflection of zero can be achieved by matching the impedance of the absorber with the impedance of free space through adjusting the geometric parameters of the structure to make the relative permeability μr and the relative permittivity Ɛr of the same value,

$$R(\omega) = \frac{Z(\omega) - Z_0}{Z(\omega) + Z_0}$$

$$Z_0 = \sqrt{\mu_0 / \varepsilon_0} = 377\Omega$$

$$Z(\omega) = \sqrt{\frac{\mu_0 \mu_r(\omega)}{\varepsilon_0 \varepsilon_r(\omega)}}$$

The proposed structure is simulated in HFSS using periodic boundary conditions (master slave and floquet port) and the result of absorbtion is shown in Figure2.The proposed structure exhibits a broad bandwidth of 2.7 GHz ranging from 6.9 to 9.6 GHz with absorbtion of 95%.
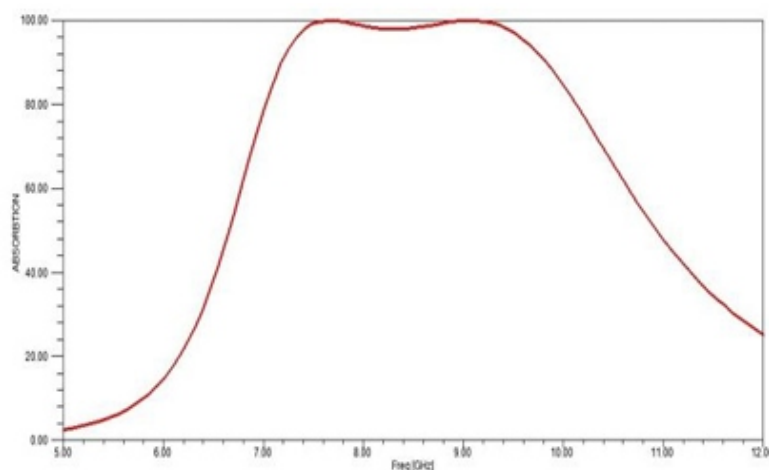

Figure 2. Simulated absorption performance of the proposed structure for the normal incidence EM wave.

III. DISCUSSION AND RESULT:

The surface currents of proposed structure at the peak frequencies on the top and bottom surfaces are shown in figure 3.
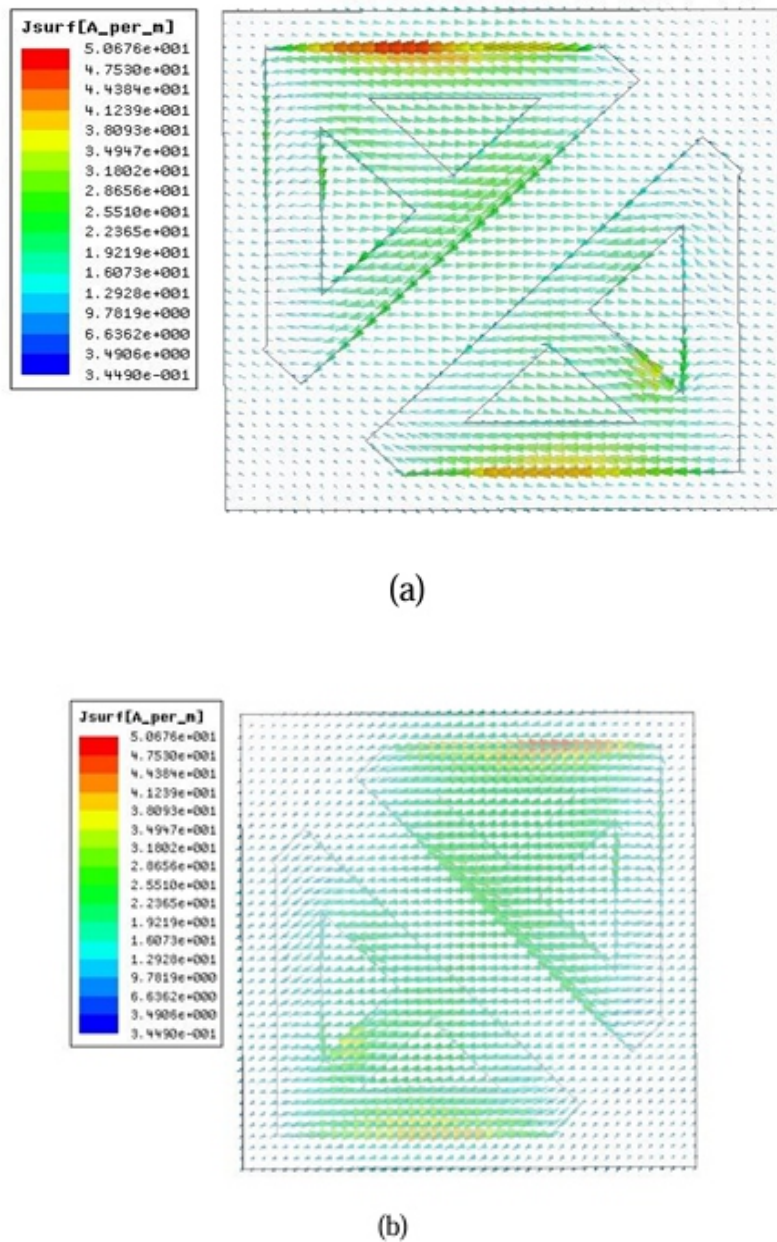

(a)

(b)

Figure 3. Surface current density distributions at the (a)top and (b bottom surface of the proposed structure.

The counter parallel ground streams at the 2 steel fixes as obtrusive from figure 3 shape a round contemporary-day hover inside the substrate, that is obliged by means of using the event appealing subject, thusly making fascinating excitation.

The provoked electric fields inside the structure are in addition confirmed up in decide.Four at the frequencies of satisfaction, making electric excitation. The masking of these excitations results in
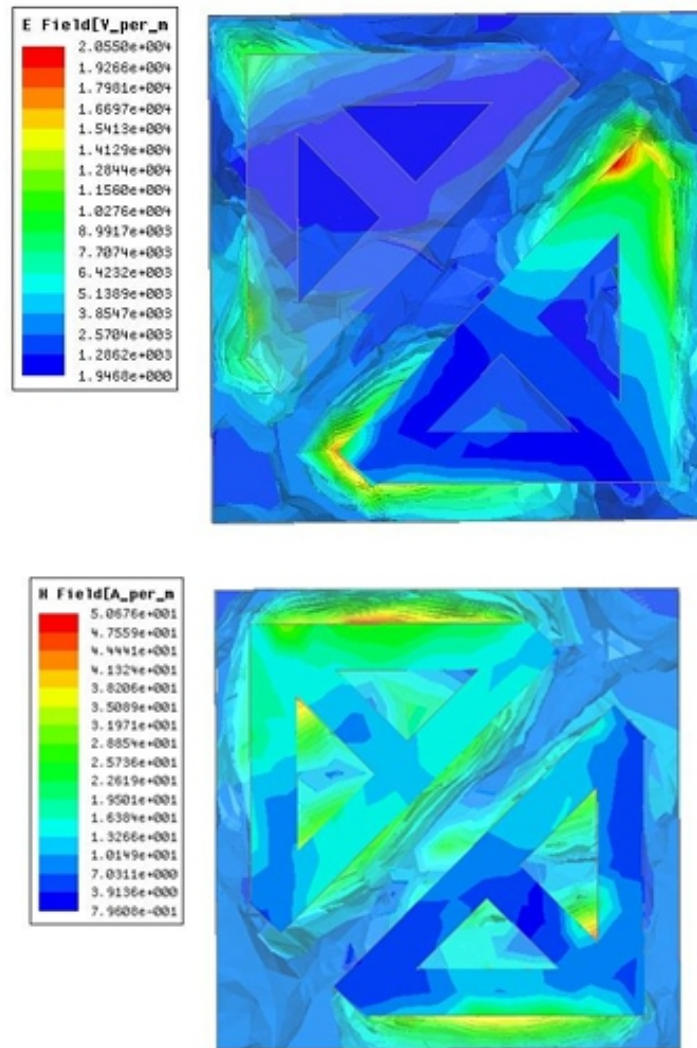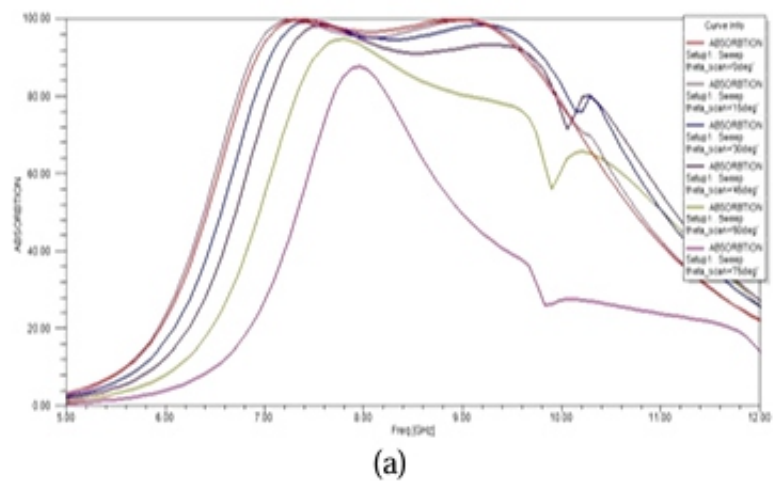
strong electromagnetic protection.

Figure. 4. Electric Field and magnetic Field distributions within the proposed structure
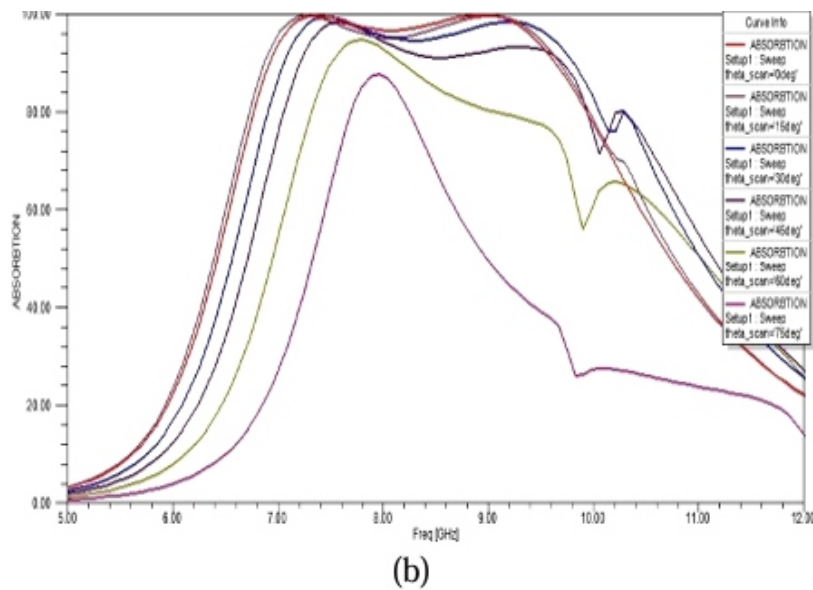

(a)

(b)

Figure 5. Simulated absorbtion response for the oblique incidence under (a) TE polarization and (b)TM polarization

The shape is copied for one-of-a-type purposes of rate (θ) as exhibited in determine.five(a), underneath TE polarization. In this situation, the method for electrical locale is along x-rotate and the alluring spot and event wave vector headings are changed through method for a perspective θ. The transmission limit of good estimated osmosis is kept up upto 45° event perspective. The shape is in like manner considered for novel scene edges underneath TM polarization as plot in decide.five(b). authentic here, the course of alluring region is near to y-axis,and the electrical district and wave vector pieces of information are distinctive by methods for technique for a point of view θ. Upto 45° scene attitude, the basic ingestion exchange speed is discovered The proposed shape has in addition been concentrated for remarkable edges of polarization (φ) as attested in watch 6, wherein the method for event Emwave remains parallel to z-course at the vague time as each the electric and alluring area make a point φ with x-course and y-bearing independently.
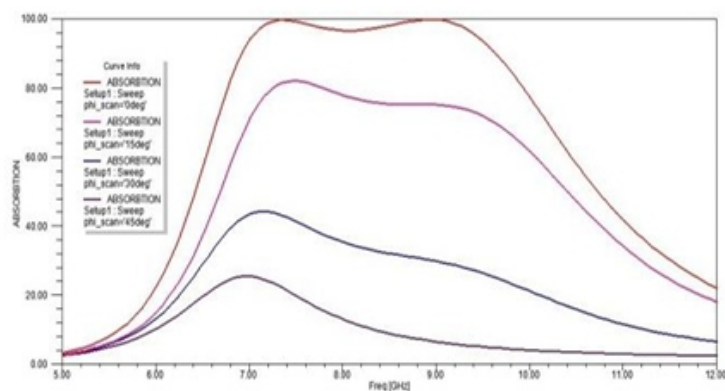

Figure.6. Simulated absorbtion response for the polarisation angle variation

The proposed shape have the 2 cowl symmetry along xy plane, the shape need to be regarded as simply upto 45° edge of polarization. The reproduced ingestion response depicts in determine 6,showing that the shape has broadband absorption upto forty five° polarization part.

IV. CONCLUSION:

A metamaterial defend has been analyzed with easy setsqaure framed patches made from copper placed corner to corner at the pinnacle surfaces. The proposed Form indicates 2.7 GHz ingestion facts transmission with over 90 5% absorptivity from 6.Nine to nine.6 GHz . The shape is really 2.07 mm thick (~ λ/15 concerning inside frequency).The occupations of a couple of geometrical parameters of the form had been targeted to solve the broadband idea of the guard. The proposed shape shows substantial osmosis trade velocity upto forty five° occasion plots for TE and TM polarizations as apparent from reproduced assessed responses.

REFERENCES:

1. Landy, N.I., Sajuyigbe, S., Mock, J.J., et al.: 'flawless metamaterial protect', Phys.Rev. Lett., 2008, a hundred, p. 207402.

2. Wang Xin,Zhang Binzhen,Wang Wanjun,Wang junlin,and Duan Junping, et al. "shape and Characterization of a Ultrabroadband Metamaterial Microwave Absorber" IEEE Photonics mag, Vol. Nine, No. Three, June 2017.

3. S.Bhattacharya, S.Ghosh, D.Chaurasiya and V. Srivastava "A Broadband huge angle Metamaterial Absorber for safety applications" 2014 IEEE international Microwave and RF conference (IMaRC)

4. S.Bhattacharya, S.Ghosh, D.Chaurasiya and V. Srivastava " A extraordinarily-wideband ultra-moderate Metamaterial Absorber based totally on spherical split rings" DOI 10.1109/LAWP.2015.2396302, IEEE Antennas and wi-fi Propagation Letters.

5. Wang Xin, Zhang Binzhen, Wang Wanjun, Wang Junlin and Duan Junping "structure, introduction, depiction of a versatile twofold band metamaterial protect," IEEE Photonics mag, Vol. 9, No. 4, August 2017.

6. Bin Tang,Yiqi Zhu,Xin Zhou,Li Huang,Xiangzhong Lang "significant angle Polarization independent Broadband Absorber reliant on cocentric Multi split ring suggests" IEEE Photonics journal,Vol.9,No.6,December 2017.

7. Senfeng Lai,Yanghui Wu,Xiaobo Zhu,Wenhua Gu,Wen Wu "An Optically transparent Ultrabraodband Microwave Absorber" IEEE Photonics mag,Vol.Nine,No.6,December 2017.

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