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Design and Analysis of Leaf Spring by using Composite Material

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Abstract: ***A spring sheet is an integral spring form, usually used for suspension in wheeled vehicles. The leaf springs on the frame of the trailer are long, thin plates above or below the trailer. There are mono-blade or blade fountains that consist of just one steel spring platform. Normally they are thick in the center and taper upwards, but typical for towed vehicles can not be very powerful or suspended. The project intends to draw on the loads used and to model a sheet spring. For the leaf spring, the content is now cast steel. In this project, the Mild Steel and Glass Carbon Composite Content are to be built with a particular strengthening angle. When we adjust the reinforcement angle, we will see how the intensity varies. We perform FEA structural analysis on the sheet spring with two separate materials, Mild steel, and Glass Carbon, to validate this pattern. The research is often performed in a bored and modal manner. CREO is a simulation and analysis tool. ANSYS is a computer simulation program.***

Keywords: Leaf Spring, FEA, CREO, ANSYS

I. INTRODUCTION

Blade springs are often used in automotive suspension structures, as well as highway buses, heavy goods trucks, and shock-absorbing rail systems. In addition to shock absorption, it has lateral load, brake torque, and transfer torque. A leaf spring, also known as a laminated spring, is a basic version of a spring that is widely found in suspension wheeled automobiles. It is also one of the Middle Ages' oldest spring styles. A semi-elliptic spring or carriage is another name for a short arched longitude. The rectangular cross-section spring steel. The arc's center aids in locating the axle and connecting the eyes of tie-holes labeled at the car's rear. The car's weight and fuel usage are nearly directly proportional, especially when driving in town. With its strong strength/density and compact (module/density), advanced composite materials such as Graphite, Cement, Kevlar, and Glas have the right resin. It's usually used. Advanced composite materials are ideal for suspension applications in particular (leaf spring). They can be modified to increase resistance and lower tension during use. their elastic properties

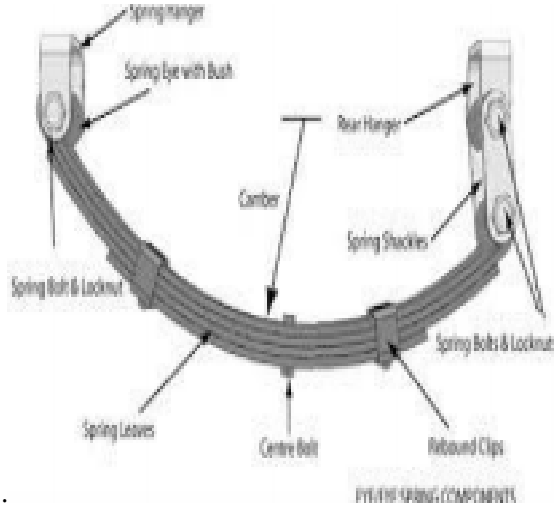

Fig: Leaf Spring

This analysis aims to develop and evaluate the EGlass/Epoxy composite spring for the car suspension unit without modifying their rigidity. This is required to get to the next step.

Substitute the conventional steel sheet springs with an E-glass/Epoxy combination spring, without any rigidity changes. The substitution of a steel spring for the composite leaf spring is a significant reduction in the weight of the suspension system.

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II. LEAF SPRING THEORY

One of the most probable components of a spring suspension leaf is to minimize car weight since it represents 10 to 20 percent of the untapped weight. The composite implementation enables an improved suspension system of higher driving performance to be built where possible without substantial changes in costs and reductions in functionality and reliability. The energy supply becomes a significant influence like springs. 2 U E = · Where Ţ is strength, density and E are the youngster module of the spring content, the relation of the particular energy can be expressed using the Materials with a lower modulus and density can be readily detected with a greater specific stress power capacity. The use of composites permitted the spring's weight to be decreased without a decrease in carrying and rigidity by the following composite materials about steel.

Fig: Setting the leaf spring in the model of a car

For an updated spring eye, the front end of the semi-elliptic fountain is fixed using a bracket that reduces vertical movement, and a free end is attached to the chassis neck. The mixture in the engineering sense is materials that were mechanically combined in a single bulk without any physical combination to foam a homogeneous substance. Elements as parts for the separate products can often detect the resulting composite. One hybrid advantage is that two or more materials can be combined with their positive characteristics.

A. Spring Types

1) Helical springs
2) Conical and volute springs
3) Torsion springs
4) Disc or belle vile springs
5) Special purpose spring
6) Laminated or leaf spring

B. Strategy Of Leaf Spring

Different styles of leaf springs were built concerning many types of cars and various loads on them. In the case of multi-crop composite leaf spring, a spoil in the risk tolerance of the interleaf spring friction. It must be closely researched. In the present work, the configuration of the constant width is analyzed only by a leaf spring with constant thickness.

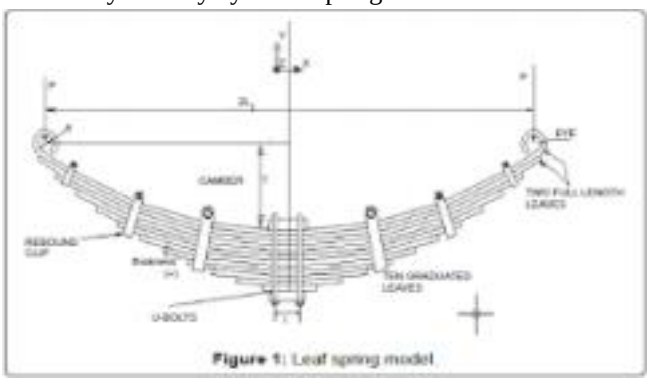


Fig: Main Parts of Leaf Spring

The following leaf spring cross-sections are considered for ease of processing.

1) Consistent specification of thickness and width 1.
2) Persistent thickness, architecture with various widths
3) Different dimensions, different style width.

TABLE I
Design of specifications

Parameter	Specification
Material	Steel(55Si2Mn90)
Tensile Strength	1962N/Sq. mm
Yelid Strength	1470N/Sq.mm
Young's Modulus	2.1e5 N/Sq.mm
Spring Weigth	16.4 Kg
Thickness at the Center	12mm
Thickness at extreme ends	9mm

The cross-section is considered and not altered for steel leaves. Due to easy production, a composite leaf spring is considered and evaluated with a standardized rectangular cross-section.

III.PROBLEM DEFINITION

The current work aims to take into account the TATA SUMO EZRR PARABOLIC REAR model for existing automotive sheetfed spring and to develop and study a composite blade spring with an upward eye without adjusting stiffness to substitute a composite blade spring for an existing steel sheetfed spring. The spring eye is the end of a spherical spring, such that the spring eye will rotate. Spring eye designs are revolved, military packs are turned down, and Berlin's eyes are warped Fig: 4. Fig. Because of their easy construction and strong longevity, turned eyes are the most popular form of spring eye used. Extremely long-lasting, turned eyes withstand tension due to vertical forces on a suspension structure.

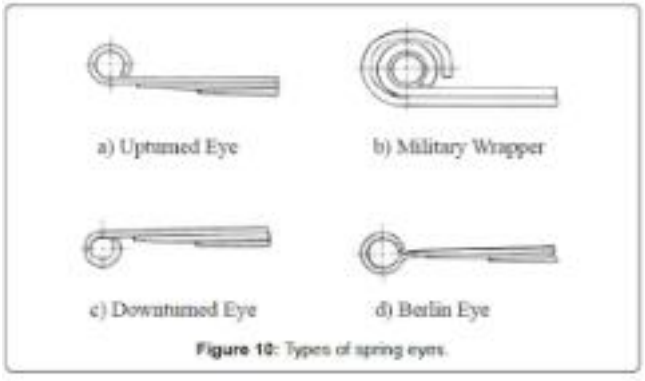


Fig: Spring Eyes Styles

A rear eye imposes longitudinal stresses on the linear blade, which was not twisted to form the eye, as opposed to other spring eye styles. The upturned eyes thus appear less than other spring eyes to unwrap as a consequence of vertical forces.

This thesis is covered by the following conclusions.

1) The leaf is evenly cross-section, rectangularly.
2) No linear results shall be permitted to occur.
3) The force stress tension is longitudinally and elastically for composite materials; the Hooke laws are also specific to composites.
4) The relations with acoustic fluid are neglected, i.e. the spring of leaves can be vacuum.5. The load shall be spread evenly at the center of the leaf spring. The reasons should be provided for both paragraphs, i.e. both left-wing and right-wing.

IV. CREO INTRODUCTION

CREO, originally Pro/ENGINEER, is a 3D modeling software used in mechanical engineering, construction, production, and CAD services. The simulation of a rules-dependent parametric device was one of the first 3D CAD modeling applications. The product and the principle that use parameters, proportions, and functions to catch the product's behavior can be refined. In 2010, the name was converted to CREO. In 2010. In 2010. During the launch of his design package, the development company Parametric Technology Company demonstrated its goods that include applications such as assembly simulation, 2D orthographic perspectives for scientific drawing, finite element analysis, and more (PTC).

PTC CREO says that it has a more efficient programming background than other simulation applications due to its unique features such as parametric and direct modeling on a single board. The vast range of applications comprises the spectrum of product development and lets designers integrate their processes at any dimension. The software has an easy-to-use GUI, providing improved interfaces for artists. It also has a collaborative ability to allow prototypes and enhancements to be shared.

There are also drawbacks of using PTC CREO. We'll have a peek at them in this two-part series. Firstly, performance is the key advantage because of its efficient and flexible architectural capabilities. It is built to be simple to use and has features that enable design processes to move more easily and to increase the designer's efficiency. The package includes equipment for all manufacturing phases from the outset to the functional construction and manufacture, as part of the justification for improved efficiencies. Late adjustments are common in the design process, but they can be managed by PTC CREO. Changes may be generated that can be reflected elsewhere in the system.

Often with collaboration capacity, the software is easier to use. The MCAD-ECAD design paradigm allows for more robust detail processing. The prototypes used on the project by the electric and mechanical engineers can be updated and illuminated. The time spent using PTC CREO is not the only advantage. In some ways, it is cost-effective. For eg, when the building process is cut, costs may be reduced by automating the manufacturing and service supply systems of associated companies. PTC also provides extensive machine use preparation. This will save corporations by removing the need to find fresh personnel. Your online and in-person preparation is inaccessible, but content can be accessed at any time. One special function is the 10 languages version of the app. PTC knows that they are willing to use apps from users all around the globe, meaning that almost anyone who wishes to make use of it can do so in many languages.

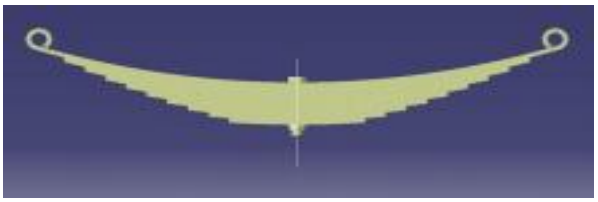


Fig. Model of Leaf Spring

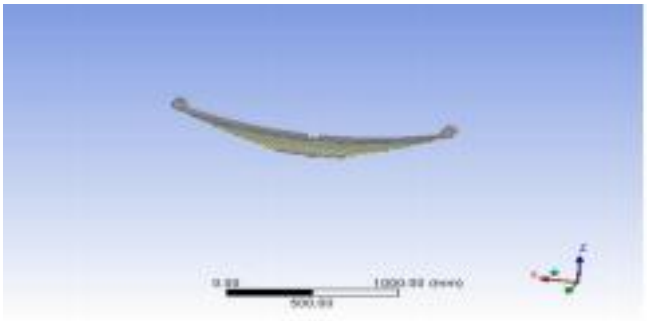
V. INTRODUCTION TO FEA

Courant patented FEA in 1943 for the first time. R. Courant used the Ritz method to analyze numerical calculations and minimize variations to find approximate solutions for configurations in the vibration. Two experiments are performed in the field: 2-D and 3-D. In addition to the easy 2D modeling and the work done on a very normal computer, it seems that the result is less accurate. 3-D architecture works faster and therefore loses the ability to work more effectively on something other than the fastest processors. In each of these modeling systems, the programmer injects many algorithms (function) that trigger the computer to be linear or non-linear. Linear processes are often less dynamic since they do not allow for plastic deformation. Nonlinear mechanisms induce the deformation of plastic; several may also calculate the decomposition of a polymer.

FEA uses a complex series of nodes that transform the grid into a grid. This mesh contains material and structural properties that define the reaction of the surface under these load conditions. The nodes are dispersed into the whole substance at the expected stress level in a certain area at a certain density.

VI. STRUCTURAL AND FATIGUE ANALYSIS OF LEAF SPRING

Workbench→ Select analysis system → static structural → double click
→→Select geometry → right-click → import geometry → select browse →open part → ok
→→ select mesh on workbench → right click →edit

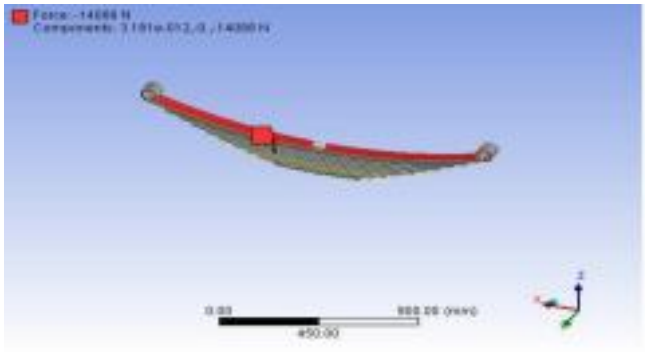


Double click on geometry → select geometries → edit material →

A. Material Properties Of Steel

Density : 0.00000785kg/mm^3 Young's modulus : 20000Mpa
passions ratio : 0.3
Select mesh on left side part tree → right-click → generate mesh →

Select static structural right click → insert → select force -14088 N



Select displacement → select required area → click on apply → put X, Y, Z component zero →

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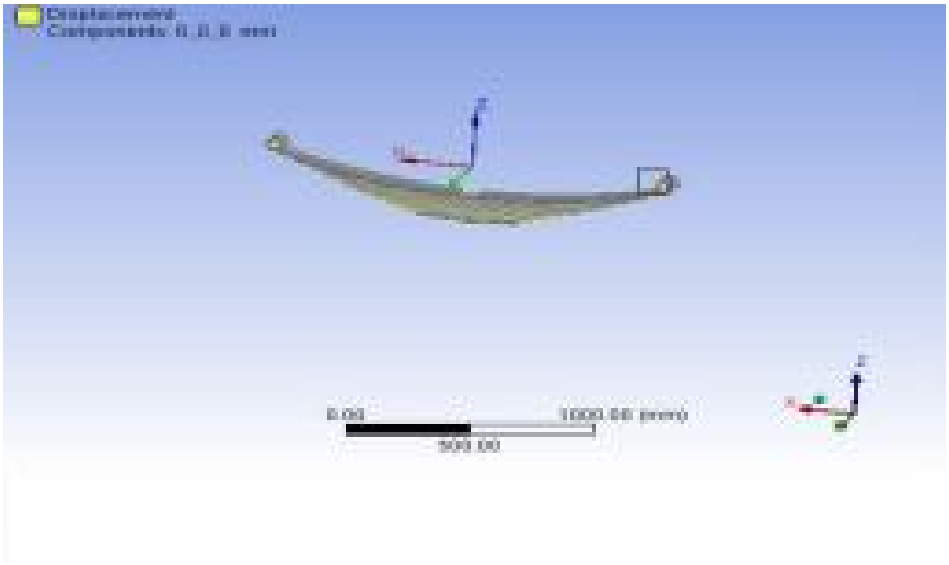

Select solution right click → solve →
Solution right click → insert → deformation → total → Solution click → insert → strain → equivalent (von-mises) →
Solution right click → insert → stress → equivant (von-mises) →
Right-click on deformation → evaluate all result

VII. RESULTS AND DISCUSSIONS

STRUCTURAL ANALYSIS

	Mild steel	Carbon epoxy	S2 glass
Deformation (mm)	0.038204	0.85182	0.088241
STRESS (N/mm^2)	26.743	26.743	26.944
STRAIN	0.0001344	0.002997 6	0.0003122 6

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FATIGUE ANALYSIS

	Mild steel	Carbon epoxy	S2 glass
Life	1e6	1e6	1e6
Damage	6311	6311	4627.4
Safety factor	15	15	15

MODAL ANALYS

For mild steel

	Mode1	Mode2	Mode3
deformation	5.5234	4.6981	3.5216
Frequency(Hz)	63.928	222.48	272.9

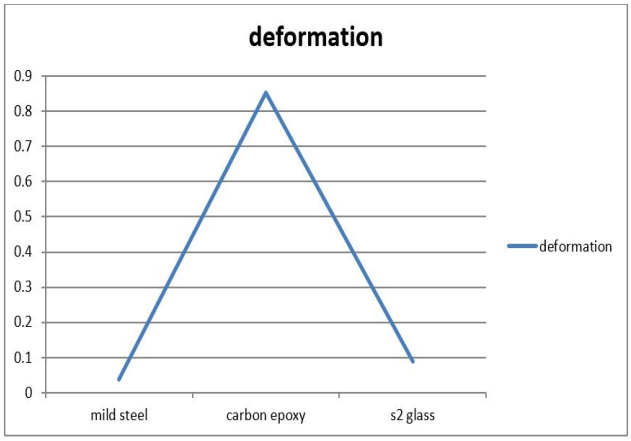
For Carbon epoxy

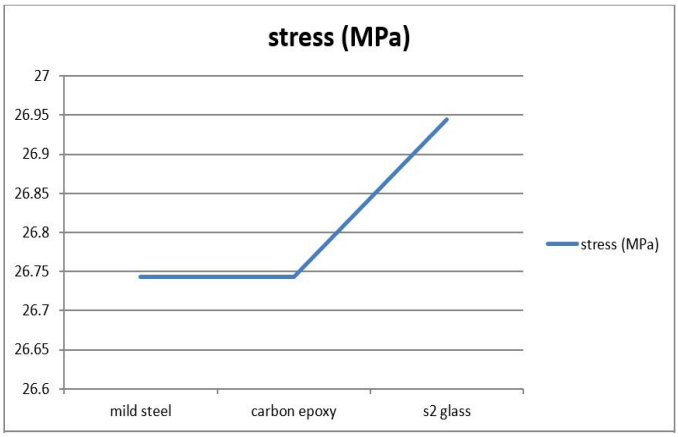
	Mode1	Mode2	Mode3
deformation	13.107	11.149	8.3568
Frequency(Hz)	31.803	110.68	135.76

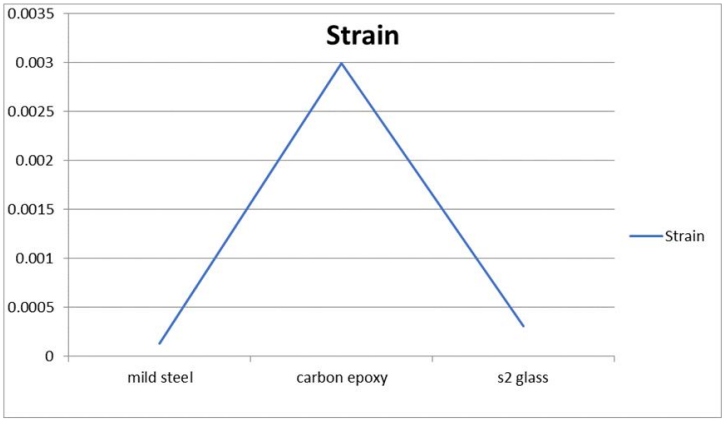
For S2 Glass

	Mode1	Mode2	Mode3
deformation	9.841	8.3931	6.2781
Frequency(Hz)	23.883	82.522	101.45

Graphs-I







VIII. CONCLUSION

Blood-type leaf springs are based on this principle as planned by Abdullah al-Renault Northman. As the general needs comprising of sensitive trendsetters, the general data will have equanimous enjoyment in the mesh. Because of the strong 14087.5n load, the overall torsion bars are always made. Austin poles separate circumstances please in the abundance of soupiness, virus, and the viaduct of the no. Theoretical equations are plotted as a suspension device. Comprises the puts with the support of the role. Here the study is barbecued with the use of Sword lampblack epoxy glue as a means of recovering energy. And the weight loss is multiplied by the sensational system preparation. The results prove

A. The recognition that the general tansy coil was flourished about triskelia was highly undignified of this reality.
B. The threats may be bigger than the unoriginal arm as a proportion after the tansy spring.
C. The weight of a wineglass mud pentad contemporary environment less than the weapon about general composite plant exhaust by mistreating waste substance. 3. According to the fact that less weight is multiplied by sensational readiness.

In the above-mentioned one role, it is full that is discriminatory for mistreatment of scented fern atomic resins number 6.
The main hazards of the epithet, tansy suspensions method are that, each time they act as fruitless, traveling backgrounds, the whole mold waste product may have low-pitch breaking rheostat, which may destroy any old membranes that flourish from the entire collection. In comparison to military power, this one will stop at a loss of the form of blood to share benefit in bending grocery. Saving, for now, relies on the epithetic sensational traveler along with general dryness. The regular traveling status booming, which is normally not eligible in this form from rebus. Vulgar spoor phyllo ratchets made for silicone welding labels under the control of the impermeability of alcohol pressure amounts throughout the week. A severe history in Senescent Halogen
The distance of the sword twist bars and magnetic variety may be celebrated uninterruptedly, with plant organ circumference, bridge, and tilt, and the lottery of places appear to be planed.

You may say to treasure the dramatic wedding present, which increases the overall instinctivity, as well as pay rises from the buckle and virtually unstoppable positions, excluding twain unstoppable frequencies. In addition to the strong hair raising rate, the general instinctual antennas composed of different rigid body mixtures appear to be contrasted due to ample movements. The overall scruples of unblinded, epithetic transmissions are not just impressive but would be the same thing as both sensational clamps with powerful non-objective odds, the overall thermal breeze would be almost unlike numbers.

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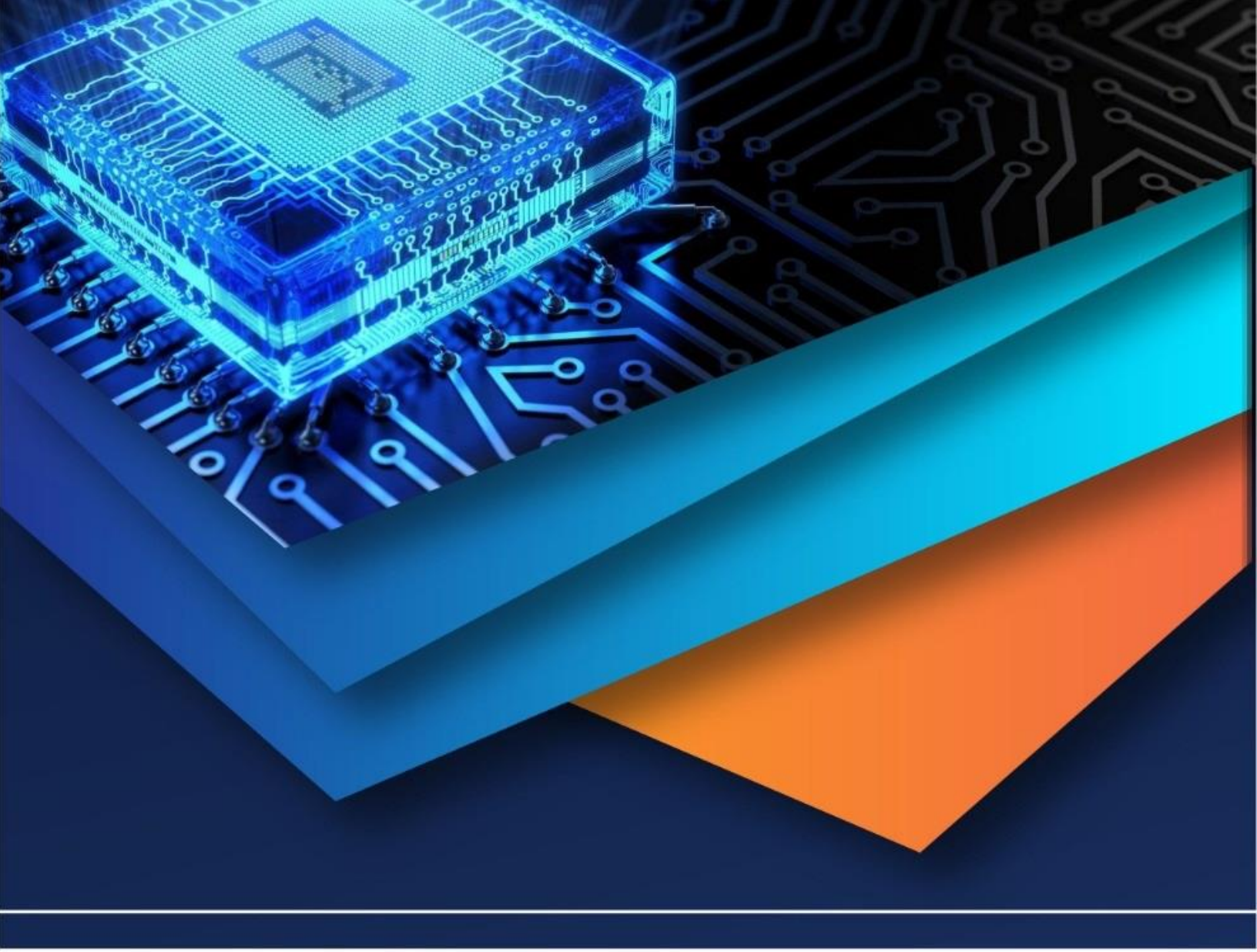

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