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Optimization of Parameters and automation for Designing of Spur Gear and Go, No Go Gauge

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Abstract: ***The design and optimization of spur gears are critical to ensuring the design matches to given Standard, They operate efficiently, reliably, and for extended durations under varying loads and conditions Optimization involves determining the best combination of parameters to meet performance requirements while minimizing costs, weight, or other constraints. Here's a detailed overview of the optimization process for spur gears***

I. OBJECTIVE FUNCTIONS FOR OPTIMIZATION

1) Automation in Selection of Parameters
2) Automation of Calculations
3) Automation of designing

II. PURPOSE

Create a Excel To Generate the Drawing of The Spur Gear as per Standard Like "DIN-5480", OR "ANSI B92.1 1970" System , and on the basis of Gear Drawing , design the drawing for Go and NO GO Gauge

III. PROCESS FLOW

1) Prepared a Excel Software , For which, Studied the Standards of the Gear like "DIN-5480", "ANSI B92.1 1970",
2) Feed all data of standards in Excel, and relate it by using Formulas from Input to Output ,
3) Prepared Standard Gear design, On the basis of dimensions of Standard Gear, Go, No Go Gauge dimensions are obtained

IV. INTRODUCTION

Gear Design for a particular Standard on the Basis of Given Input is the first and very Important Step in making of Go, No go Gauge Accuracy of Gear design directly Impacts to the Accuracy of Go, No go Gauge design, For the designing of Gear of Standard, Filled all data of standard "DIN-5480" and "ANSI B92.1 1970" in the Excel, and by giving formulas we can find the required data for particular Input, and by using the formulas given in standards, We can design the Gear of Particular Standard.
By designing gear tooth size, We can find out dimensions of Go and No go gauge for that Gear , Because of the Software Prepared in Excel, We can get Ready drawing of Gear and Go, No-Go Gauge, By Printing this drawing , We can Start Manufacturing of Go And No Go Gauge with help of Lathe Machine, CNC Machine and SPM

V. INVOLUTE SPUR GEARS

Spur gears have teeth that are shaped like an arch, with the curved portion of the arch facing outward helps to reduce sliding friction between the teeth, which allows the gears to run more smoothly.

VI. KEY ELEMENTS OF THE DRAWING

1) *Profile:* Draw the involute tooth profile, including fillets at the root.
2) *Gear Dimensions:* Clearly indicate reference, root, and addendum diameters.
3) *Tolerances:* Include tolerances for tooth thickness, diameters, and fit classes.
4) *Material and Heat Treatment:* Specify material, hardness, and any heat treatment.
5) *DIN 5480 Specification:* Mention "DIN 5480" on the drawing for standard compliance

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VII. TOOLS FOR SPUR GEAR OPTIMIZATION

1) *CAD Software:* Software like AutoCAD, CREO, SolidWorks, for designing gears.
2) *Excel:* For solving optimization equations and models.
3) *Gear Design Standards:* Follow standards like "DIN-5480", " ANSI B92.1 1970"

VIII. KEY DESIGN PARAMETERS FOR SPUR GEARS

1) Pitch: The distance between two tooth on a gear, usually measured in millimetres or inches.
2) Module: The Module is the ratio of pitch by the number of teeth on the gear
3) Pressure Angle: It is angle between the tooth profile and a tangent line to the pitch circle.
4) Backlash: The clearance between the meshed teeth on two gears is called Backlash.
5) Root Diameter: The base diameter of teeth of the Gear.
6) Tip Diameter: The top diameter of the teeth of Gear
7) Face Width: The width of the Gear by two sides
8) Pitch Circle Diameter (PCD): The pitch circle diameter (PCD) is the diameter of the pitch circle. Two Gears meets at the Pitch Circle
9) Base Diameter of Gear:- Diameter of base circle is Base dia of Gear
10) Form Dia: The Diameter of a circle at which the root fillet curve intersects or joins the involute is called Form Diameter.
11) Circular tooth thickness Max eff:- C.T.T. Max eff is Circular tooth thickness Maximum of gear
12) Circular tooth thickness Min Actual:- Circular tooth thickness minimum actual of gear

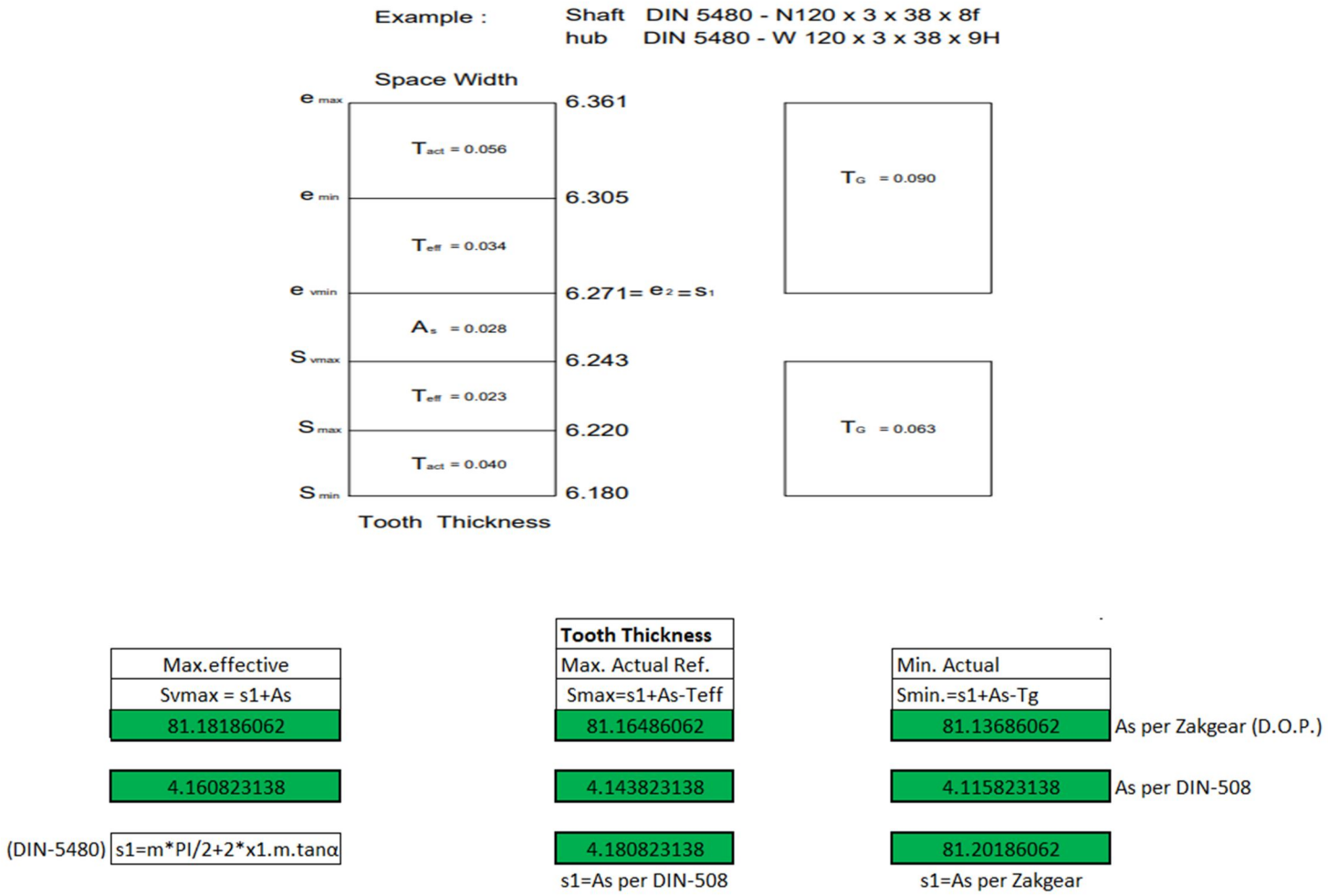


Fig. 1.1 Tooth Thickness and Space width of mating Gears as per Standards DIN-5480

13) D.O.P.:- D.O.P. is dimension taken between two Pins which are place in between teeth of Gear at angle of 180 Degree.
14) Pin Size :- Diameter of Pin to check D.O.P.

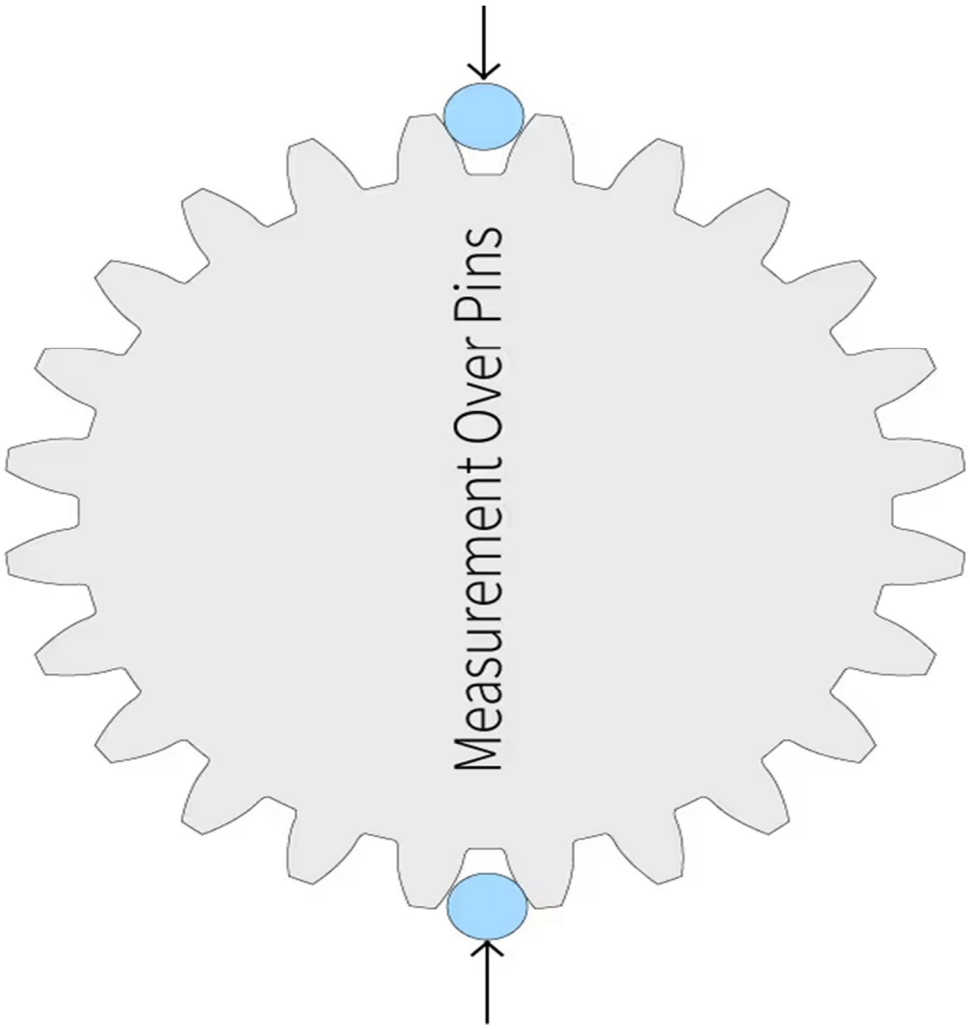


Fig. 1.2 Measurement Over Pins

IX. MATERIALS

Steel, cast iron and bronze , M35, ANSI 0205

X. METHODS

1) Designed a Excel Sheet to calculate D.O.P. from given tooth thickness of Gear
2) Design Excel Sheet to calculate Circular tooth thickness of External gear from given D.O.P. and Pin Size
3) Spur Gear design for Standard "DIN-5480" in Excel
4) Spur Gear design for Standards "ANSI B92.1-1970" in Excel
5) Main sheet design for Spur Gear
6) Spur Gear design from DOP method also be designed by this Excel Software
7) All related Data of "DIN-5480" is filled in Excel Sheet
8) All related Data of "ANSI B92.1-1970" Standard is filled in Excel sheet
9) All related Information required to complete the Output drawing is taken in different cells
10) i.e. Drawing no, Customer Name
11) Output Drawing is generated in Excel Sheet
12) 3D Model of Spur Gear and Go , No go Gauge is generated

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XI. EXAMPLE WORKFLOW

1) Define input parameters in Excel
2) Output dimensions of Spur gear will be calculated automatically
3) Get The Final Drawing for Print
4) Generate involute profile in CAD software.

XII. RESULTS

We have Optimised parameters required for designing of Spur Gear and Go, No- Go Gauge , by designing software in Excel

1) Designer do not required knowledge of Standards because All Information of DIN-5480 Standard, and ANSI B92.1-1970 Standard is Filled in Excel
2) Designer have to just feed the Input Parameters and all necessary Information about that Spur Gear will be calculated automatically through the formulas
3) Designer can get tooth thickness on the basis of DOP through the automatic calculations
4) Designer can get DOP on the basis of tooth thickness through the automatic calculations
5) Excel sheet is designed to obtain particular tolerances from the Input and tooth Thickness is obtained for DIN 5480 Standard.
6) Excel sheet is designed to calculate ANSI Standard dimensions
7) This is the process done manually by designers , We are automating these calculations through Excel Sheets
8) We can get “Production drawing” as well as “Client Drawing” in Excel
9) We can create pdf file of output drawing also or we can print output drawing also

A. *Output Drawing*

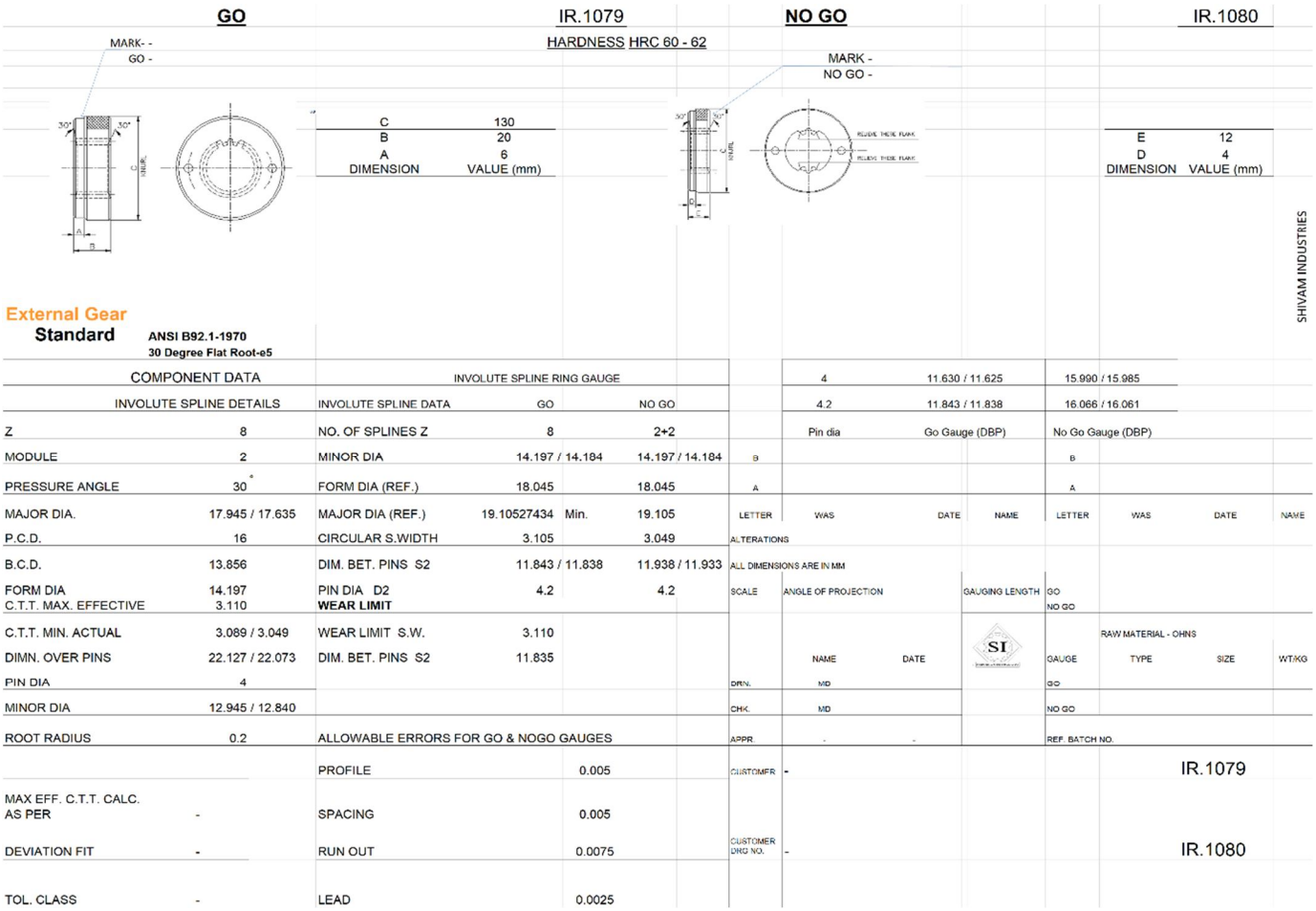


Fig. 2.20 Final Output Drawing for Spur Gear and Go, No-go Gauge

B. 3D Model of Gear

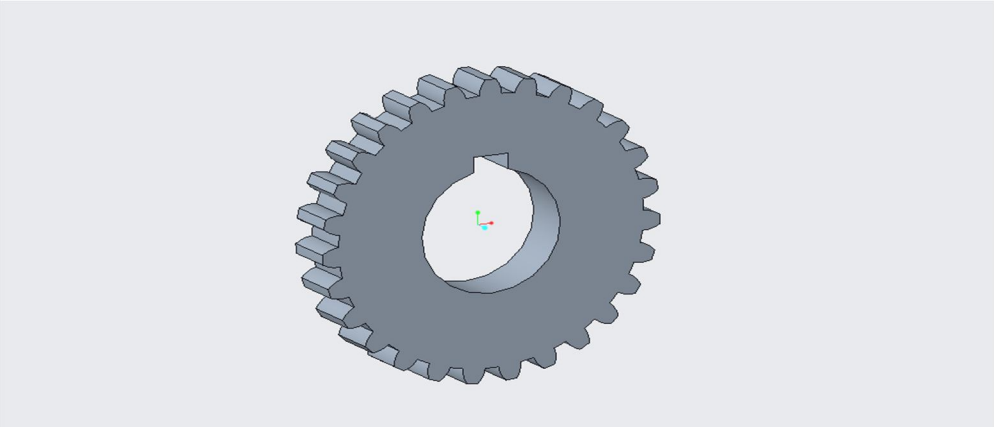


Fig. 2.21 3d Model of Spur Gear

C. 3D Model of Go Gauge

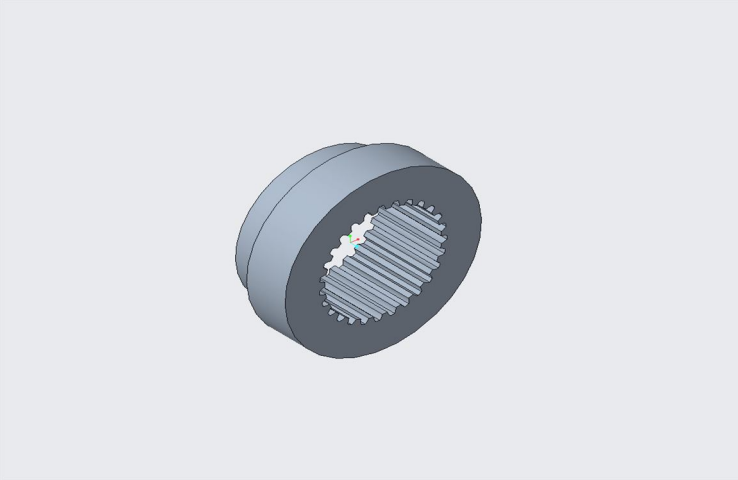


Fig 2.22 3d Model of Go Gauge

D. 3D Model of NO Go Gauge

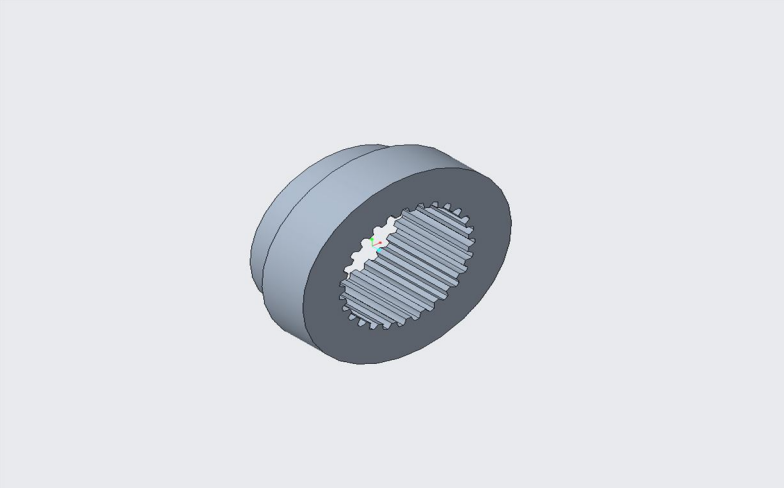


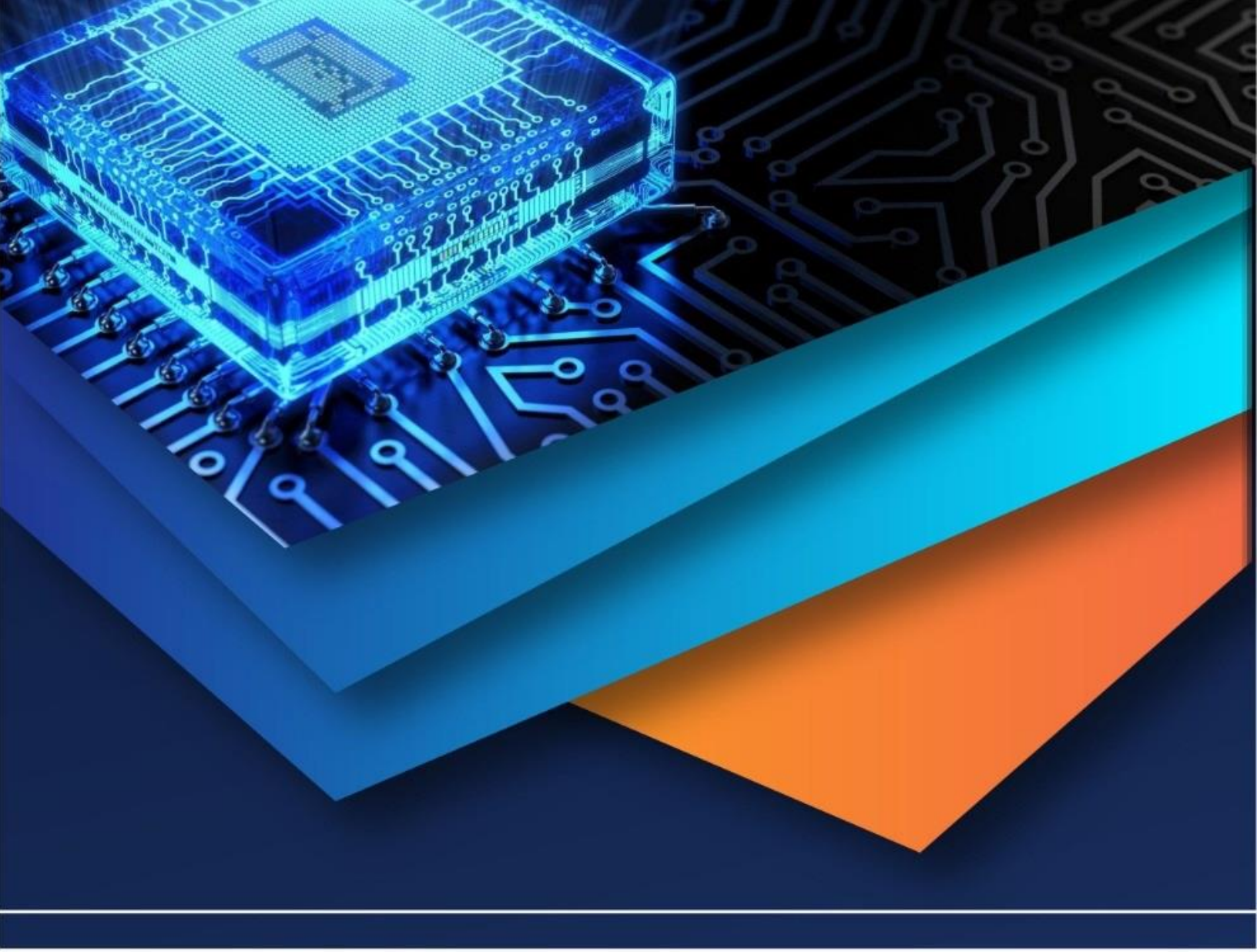
Fig. 2.23 3D Model of No go Gauge

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XIII. CONCLUSION

1) Traditionally designers have to search the parameters in DIN Standard or ANSI B92.1 1970 Standard and do the calculations , however there may be chances of human errors during selection and calculation of values,
2) Manual calculations and manual search for appropriate values of parameters are time consuming process, however our process reduces the designing time and calculations required for designing Go and No Go Gauges and Spur Gear of specified Standard.
3) Our process reduces the comprehensive knowledge of DIN Standard and ANSI B92.1 1970 and knowledge of designing of Go and No-go gauges for Spur gear and required dimensions.
4) Optimizing spur gear parameters requires balancing multiple objectives, such as minimizing weight and cost while maximizing strength and efficiency. Leveraging advanced mathematical models, optimization techniques, and simulation tools ensures the development of high-performance and reliable gear systems tailored to specific applications.
5) We can Design Gears of Standard like “DIN-5480”, “ANSI B92.1 1970” and Go, No go Ring Gauges for Gears by Preparing software in Excel

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