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Design and Analysis of Drill Bit with Various Materials Using ANSYS

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Abstract: The reason for the study is to design and examination of drilling tool with different material including the substitution of existing material and the mechanical properties of the boring apparatus material which is utilized for the matching motivation behind axle development at different paces. The present material is outlined out and examination is done and separated and the proposed material. The drill bit was designed by the solidworks software by using present drill bit dimensions. Finally, it is analyzed by various materials in the ANSYS WorkBench Software.

Key words: Drill bit, deformation, ANSYS, meshing, materials, utilized

INTRODUCTION

The development of push torque with cutting time was recorded utilizing the dynamometer. The greatest level of push drive acquired amid penetrating tests is exhibited. The most extreme push constrains acquired with new and old drills are displayed for the diverse estimations of point edge and cutting velocity considered (Huang and Dareing, 1969; Baryshnikov *et al*., 1997; Wang *et al*., 2004). NLO properties of a new crystal from amino acid family and its investigation on structural, optical, mechanical are evaluated by Senthil *et al*. (2015). Mechanical properties aluminium metal matrix composite for marine applications is discussed by Venugopal and Manoharan (2015). By Mohan and Manoharan (2015) it portrays the experimental investigation of tensile and impact behaviour of aluminium metal matrix composite for turbocharger. A performance, emission and combustion characteristic of a diesel engine is explained (Manickam *et al*., 2015) with the effect of thermal barrier coating on the piston crown using biodiesel. In this study (Subramaniyan *et al*., 2015; Aravindkumar, 2014) it shows the controllability of second order impulsive neutral functional integral differential inclusions with an infinite delay.

Boring operation is the most usually utilized machining operation that utilizations multipoint cutting device called bore or boring tool to evacuate undesirable material for creating or growing want gap. The primary concentrated of present day machining businesses on accomplishment of high calibre in term of research piece bored exactness and surface wrap up. Surface complete is worried about the geometrical abnormalities on the surface of material. Surface unpleas antness is the one of the essential execution parameter that appreciably affects mechanical properties of completed parts for example, crawl life, weariness conduct and erosion resistance and so, forth. The geometry of cutting apparatus, work materials and parameters like cutting velocity and sustain straightforwardly influences penetrate execution. These parameters ought to be chosen to enhance the boring operation. So, it can be accomplished by capacity of penetrating conditions utilizing plan of tests (DOE). An enhancement is done on proposed research with the assistance of reaction surface strategy for greatest metal evacuation rate, least surface unpleasantness and least gap breadth mistake.

MATERIALS AND METHODS

The property of the drill bit which currently exists is tabulated in Table 1. These properties will be assigned to the model of the drill bit, using the ANSYS Software. After assigning the properties to the model, the model is meshed. After the meshing process the load conditions are applied then the analysis is done. Finally, the results are obtained. The obtained results represent the materials ability to withstand the load conditions. The same process is done for the proposed material by modifying the material properties alone. The material properties for the proposed material are shown in Table 2.

Modeling and meshing: The modeling is done by using SolidWorks Software. The created model is shown in Fig. 1.

Table 1: Material properties of existing drill bit

Properties	Values
Material	Carbon steel
Volume	355.95 (mm^3)
Co ordinates type	Cartesian
Mass	8.322e-003 (kg)
Nodes	302
Elements	168

Solidworks Software is one of the best user friendly software for 3D Modeling. After the modeling, the created model is exported to the ANSYS WorkBench Software for analyzing. ANSYS WorkBench Software commonly used maximum industries to analyzing.

Table 2: Properties of proposed material

Material	Hardened steel
Density	25.33 (g/cm³)
Yield strength	35 (Mpa)
Compressive strength	3621 (MPa)
Modulus of elasticity	278 (GPa)
Vickers hardness	2345
Thermal conductivity	0.22

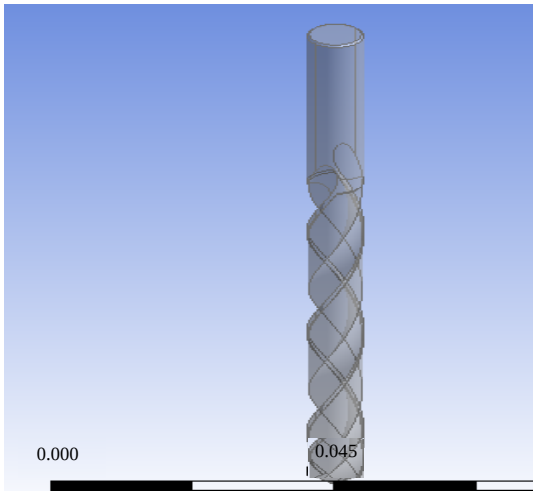

Fig. 1: 3D Model of drill bit

Displaying was done on ANSYS design modeler. A plate with length across 175 mm and thickness 12 mm and a stick with 6.1 mm breadth and 25 mm thickness were displayed in ANSYS design modeler. At that point they were collected legitimately as appeared beneath with a wear track range 40 mm from the focal point of the circle.

The meshing is the important step in the ANSYS. In the meshing step, the model was divided as more elements. The division is helps for getting accurate result. Figure 2 shows the smooth mesh which was created from ANSYS Software.

Analysis: The cutting tool's directional deformation is shown in Fig. 3. The maximum value and minimum values are clearly shown in Fig. 3. The direction deformation of the drill bit tool is 1.94 mm in the z direction.

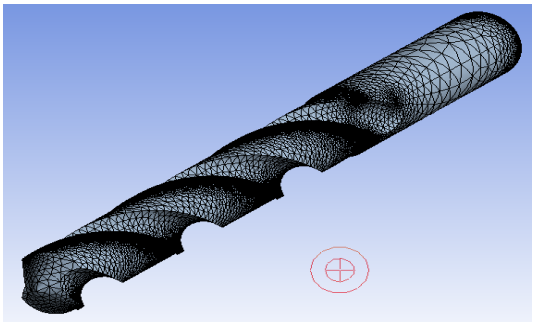

Fig. 2: Meshing of bit

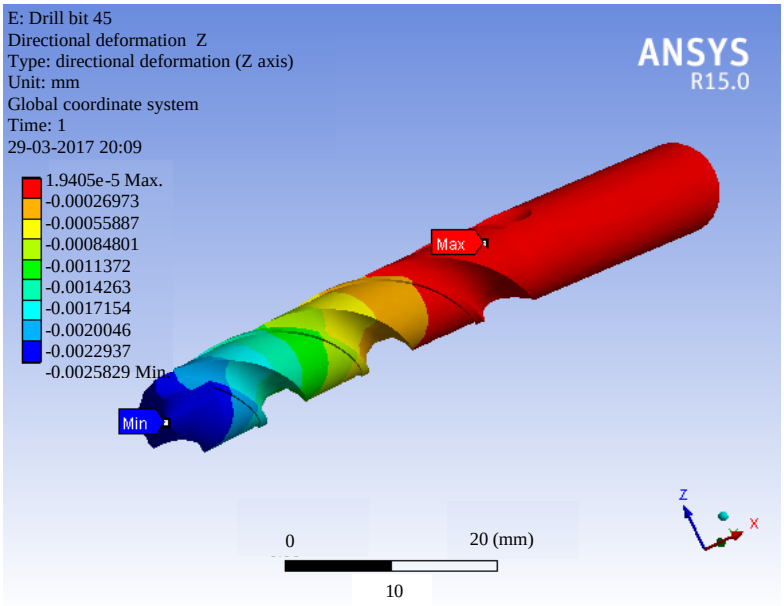

Fig. 3: Directional deformations

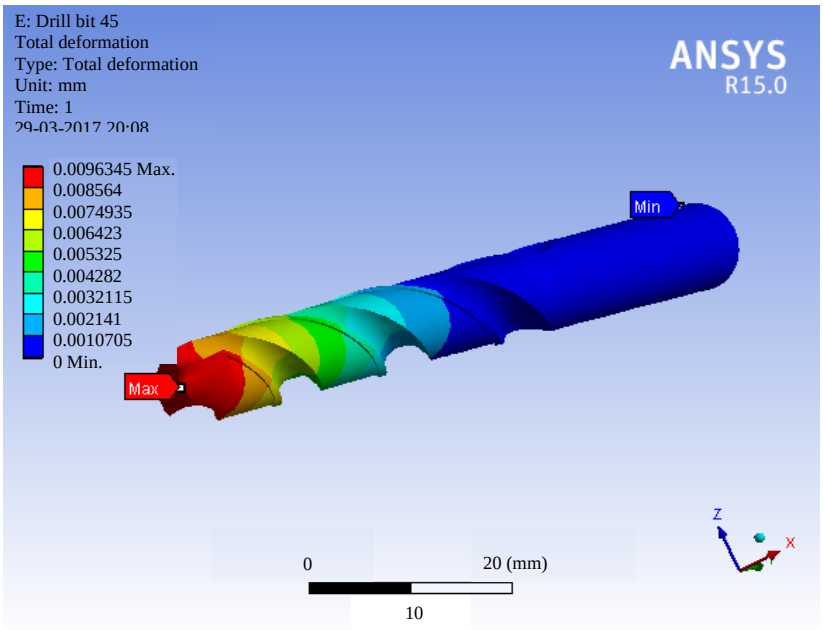

Fig. 4: Total deformation

Table 3: Analysis results for different materials

	Results		
Material	Stress	Displacement	Sliding contact
Harden steel	20.25	0.33e-3	0.841e-5
Cast iron	10.23	0.38e-3	0.354e-4
carbon steel	35	0.39e-3	0.165e-4

The deformation value is the important one for every component. Figure 4 shows the total deformation values of the drill bit. By the result the drill bit has safe stress value due to the load condition (Table 3).

RESULTS AND DISCUSSION

Analysis results are shown in Table 3. Table 3 shows that the hardened steel material has 20.25 MPa stress at distance of 0.841e-5. The cast iron has less stress than the other two materials. The carbon steel has more stress as the 35 MPa at 0.165e-4. From the above analyzing the proposed material is safer than the existing material.

CONCLUSION

Thus, the modelling and analysis part shows the strain and stress constants in the field of research and the values has been derived. By this analysis the proposed material harden steel is safer than the existing material carbon steel. By using the harden material to fabricate the drill bit, we can increase the tool life and reduce the tool damage. And economically it's not more cost than the existing material.

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