

## Analysis and Optimization of CNC Machine BED Using ANSYS

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**Abstract:** The point of the research is to model and examination the employment bed as of now present in the CNC machine with a scope of material together with the existing material substitution and the physical and mechanical properties of the bed which is utilized as a part of operation of occupation machining. The material utilized as existing in employment bed is composed and examination is yielded out with correlation of proposed material. The results are plotted and talked about.

**Key words:** Computer Numerical Control (CNC), ANSYS, deformation, material, occupation, bed

### INTRODUCTION

CNC is the machine utilized for modernized numerical control which the machining of the occupation is performed by the PC control (Selvakumar and Mohanram, 2012). The machines keeps running on a coding with the wellspring of pivot course along the plane of directions. Abuthakeer *et al.* (2011) comprises analysis of alternative composite material for high speed precision machine tool structures. The traditional basic materials utilized as a part of accuracy machine instruments for example, cast iron and steel at high working paces create positional mistakes because of the vibrations moved into the structure. Sivarao *et al.* (2010) Speedier cutting paces can be gained just by structure which has high solidness and great damping qualities. Structural redesigning of a cnc lathe bed to improve its static and dynamic characteristics is illustrated in studies (Sequeira *et al.*, 2011; Subrahmanyam *et al.*, 2013). The three dimensional model of the CNC machine bed is created by the SolidWorks Software. The created model is shown in the Fig. 1.

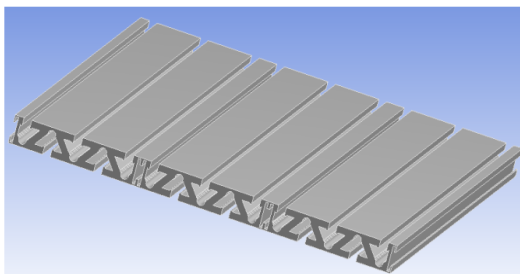


Fig. 1: 3D Model of CNC bed

### MATERIALS AND METHODS

The material properties of the both existing and proposed materials are shown in the Table 1 and 2. The cast iron is the existing material which is used for fabricate the CNC machine bed. In this study, the cast iron is replaced by the composite materials.

The composite material is known as combination of two or more materials. In this study, the two types of composite materials are used to analysis the CNC machine bed. One is synthetic composite and another one is natural composite. The e-Glass fiber composite is a synthetic composite and jute fiber composite is a natural composite which two materials are used to analysis the CNC machine bed.

**Meshing of CNC bed:** The meshing model of the CNC machine bed was shown in the Fig. 2. The meshing model was created in the ANSYS WorkBench Software. The fine

Table 1: Existing material properties

Properties	Values
Volume	568.12 mm <sup>3</sup>
Material	Cast iron
Coordinates type	Cartesian
Mass	65.124e-003 kg
Nodes	325
Elements	244

Table 2: Properties of proposed material

Properties	Values
Material	Silicon carbide
Density	9.20 g/cm <sup>3</sup>
Yield strength	120 MPa
Compressive strength	3241 MPa
Modulus of elasticity	421GPa
Vickers hardness	3641
Thermal conductivity	12.02

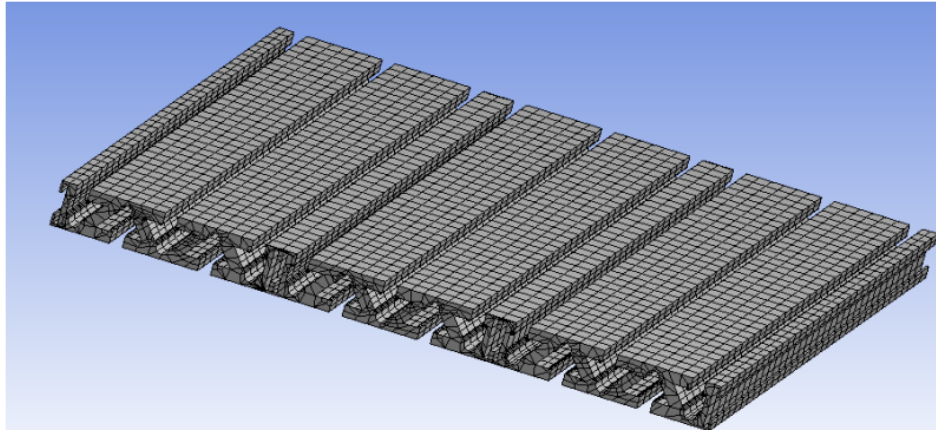


Fig. 2: Meshing in ANSYS

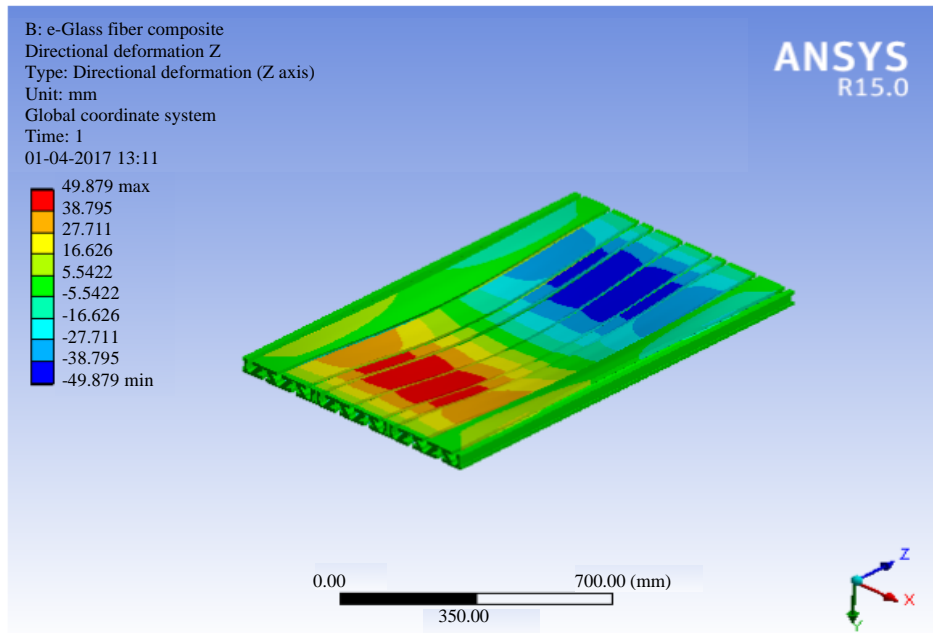


Fig. 3: E glass fiber deformation

size and high smooth meshing operation is done in the CNC machine bed. The mapped meshing operation is done in the CNC machine bed. In the analysing, the meshing is most important one. By the meshing the solid model is divided to more number of elements and nodes.

**Structural analysis:** The created three dimensional model of the CNC machine bed is analysed in the WorkBench Software. The static structural analysis is selected for this CNC machine bed. Tin this analysis, there are two different composite materials are selected. They are jute

composite material and e-Glass fiber composite. Both materials results are shown in the Fig. 3 and 4. Figure 3 shows the deformation rate of the CNC machine bed by using the E glass fibre material.

Figure 4 shows the deformation of the CNC machine bed by using the jute fiber material. The maximum deformation point is denoted by the red colour and the minimum deformation point is denoted by the blue colour. The jute fiber composite material result is compared with the e-Glass fiber composite and also it is compared with the existing material.

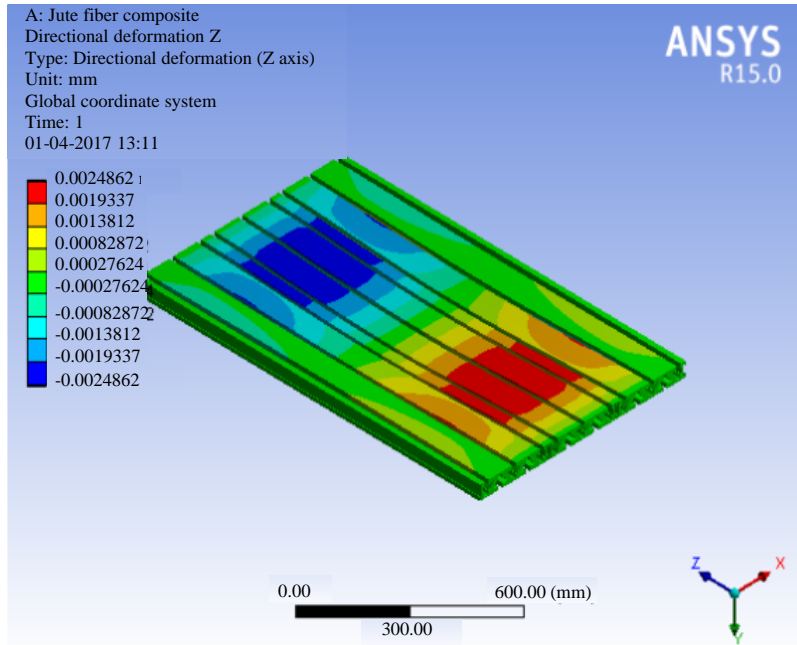


Fig 4: Jute fiber deformation

Table 3: Results and comparison

Materials	Results		
	Stress	Displacement	Sliding contact
Cast iron	14.23	0.12e-3	0.132e-5
e-Glass fibre	10.45	0.23e-3	0.165e-4
Jute fibre	06.23	0.65e-3	0.198e-4

**RESULTS AND DISCUSSION**

The jute fiber composite result, e-Glass fiber composite result and existing material results are tabulated in the Table 3. The results of the all materials are taken from the ANSYS. The all of the materials are analysis in the same boundary conditions. By the analysis the both composite materials are give better property than the existing material cast iron. The cast iron has 14.23 N/mm<sup>2</sup> stress but the other two composite materials are had less stress value.

**CONCLUSION**

The CNC machine bed was successfully created by the SolidWorks Software and it also analysed by the various materials using the Ansys WorkBench Software. Thus the analysis and modelling describes the stress and strain constrains in the element of research and the derived values are plotted. By the analysis, the jute fiber

is better than the both e-Glass fiber composite and existing cast iron material and also, jute fiber material was economically low than the existing material.

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