# A Review on FEM Analysis of CNC Slanted Bed

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Abstract—In the field of Engineering we come across many complex problems, the solution of which extremely tedious and usually not possible by analytical methods. In such case we have to resort to the use of Numerical Techniques. "Finite Element Analysis" is an extremely powerful Numerical Technique for the solution of complex problems. In this project, work is carried out to reduce the weight of the machine bed without deteriorating its structural rigidity and the accuracy of the machine tool by adding ribs at the suitable locations. In this work, the 3D CAD model for the base line and the design has been created by using 3D modelling software CREO. The objective of this project is to carry out analysis (IN ANSYS) and to validate the actual load carrying capacity of slanted bed of CNC machine.

**Keywords**—Finite Element Analysis, Creo, 3d Modelling, ANSYS, CNC Machine.

### I. INTRODUCTION

Finite element method (FEM) and analysis (FEA) are two of the most popular mechanical engineering application offered by existing CAD/CAM systems. This is attributed to the fact that the finite element method is perhaps the most popular numerical technique for solving engineering problems. The method is general enough to handle any complex shape or geometry, any material properties, any boundary condition, and any loading condition. The generality of the finite element method fits the analysis requirements of today's complex engineering systems and designs where closedform solution of governing equilibrium equations are usually not available. In addition, it is an efficient design tool by which designers can perform parametric design studies by considering various design cases (different shapes, materials, loads, etc.), analyzing them, and choosing the optimum design. The finite element method is a numerical analysis technique for obtaining approximate solution to a wide variety of engineering problems. Let us takes an example of a Stress Analysis problem of a body under certain loading conditions. The normal analytical procedure would involve taking an extremely small box element of dimensions (dx, dy, dz). Each tending to zero and then writing down the equations of equilibrium and compatibility for this element. Then we would try to obtain a solution for the Stress Distribution in the body under the specified boundary conditions using the techniques of Integration over the entire body.

#### II. LITERATURE REVIEW

Malleswara Swami<sup>1</sup>, K.Sunil Rattan Kumar<sup>2</sup>, "DESIGN AND STRUCTURAL ANALYSIS OF CNC VERTICAL MILLING MACHINE BED" Dec-2012 International Journal of Advanced Engineering Technology E-ISSN 0976-3945, 97-100.In this paper, the work is carried out to reduce the weight of the machine bed without deteriorating

its structural rigidity and the accuracy of the machine tool by adding ribs at the suitable locations. In this work, the 3D CAD model for the base line and the optimized design has been created by using commercial 3D modelling software CATIA. The 3D FE model has been generated using HYPERMESH. The analyses were carried out using ANSYS and Design Optimization is done with the help of Optistruct.

S. Syath Abuthakeer<sup>1</sup>, P.V. Mohanram <sup>2</sup>, G.Mohan Kumar<sup>3</sup> "Structural Redesigning of a CNC Lathe Bed to improve its Static and Dynamic Characteristics" International Journal of Engineering-2011 ISSN 1584-2673, 389-394. These study aims to provide various form designs of machine tool structure with the help of structural modifications made in CNC machine tool bed. After the lightening effect was verified by finite element simulation, scale-down models of an original bed and vertical ribs with hollow bed models were fabricated using rapid prototyping method and tested. The dynamic characteristics of those different form designs of the bed were analyzed experimentally. Numerical analysis was done and results were validated with experimental results. Results indicated that the cross and horizontal rib with hollow bed can increase the specific stiffness by 8% with 4% weight reduction and its dynamic performances is also better with increases in the first natural frequencies. The modified design is effective in improving the static and dynamic structural performances of high speed machine tools.

N. Ashwin Kumar<sup>1</sup>, Basava Raju Pondhe<sup>2</sup> AUG-"OPTIMIZATION AND ENHANCEMENT OF 2013 LOAD CARRYING CAPACITY OF CNC COORDINATE DRILLING MACHINE USING FINITE ELEMENT METHOD"International Journal of Scientific & engineering research, vol.4, issue.8, ISSN 2229-5518. The objective of this project is to carry out analysis and to validate the actual load carrying capacity of the original design of machine bed and the new design proposed by the company, using finite element analysis. As a part of analysis for this project an optimized design of the bed was suggested by the author to endure the load carrying capacity of 14000 kg. Analysis was carried out on the bed of the machine where additional ribs were added to the bed in order to withstand higher capacity. The software's used include to carry out finite element analysis. Three stages of FEA were carried out, that is for the original bed and the bed redesigned by the company followed by the optimized bed designed by the author.

B.V. Subrahmanyam<sup>1</sup>, Srinivasa Rao,S.V<sup>2</sup>. Gopala Krishna<sup>3</sup>, Rama Krishna<sup>4</sup> "STATIC AND DYNAMIC ANALYSIS OF MACHINE TOOL STRUCTURES" IJRMET Vol. 4, Issue Spl - 1, Nov 2013- Apri 1 2014 .In this paper an attempt has been made to analyze both statically and dynamically the three machine tool structures milling, shaping, and lathe. In all machines, the

stresses are high along x-direction, is a direction transverse to the longitudinal axis. The deflection is observed to be more predominant in milling machine. It can be further concluded that the deflection is increasing with an increase in frequency.

S. S. Abuthakeer<sup>1</sup>, P. V. Mohanram<sup>2</sup> and G. "Static and Dynamic Performance Mohankumarz<sup>3</sup>, Improvement of Conventional Computer Numerical Control Machine Tool Bed with Hybrid Welded Steel" American Journal of Applied Sciences 8 (6): 610-616, 2011, ISSN 1546-9239. The objective of this study is to improve the stiffness, natural frequency and damping capability of machine tool bed using a composite material containing welded steel and polymer concrete. The results at first mode showed that the natural frequency improved by 24.7% and damping ratio was 2.7 times higher than cast iron. This study proposed a hybrid welded steel bed as a replacement for cast iron as a machine tool bed material and the results showed that the static and dynamic characteristics were superior to cast iron.

Prof. Dr. Muhsin J. Jweeg and Asst. Prof. Dr. Shawkat J. AL-Tornachi "OPTIMIZATION OF LIGHT WEIGHT CNC BED STRUCTURE" 2009. The static analysis of the CNC by ANSYS package has been presented and used to determine the optimum design for the CNC. This operation involve using the vortex lattice method to obtain the CNC result at (M=0.7) For taper wing and (M=0.2) for rectangle CNC from the CNC results it can be noticed that the lift coefficient increase with the increase of Mach number from (M=0.4) at the same angle of attacks due to the compressibility.

Mr. A. M. Joshi and Mr. R. D. Gondaliya "FINITE ON CNC SLANTED BED ELEMENT ANALYSIS MACHINE" Journal of information, knowledge research in mechanical engineering ISSN0975-668X. vol-2, 134 to 137. The machine tool is machine issue-1, pagethat imparts the required shape to a work piece with the desired accuracy of removing metal from the work piece in the form of chips. Beds, columns, bases, head stock are called "structures" in machine tool. In machine tool 70-80% of the total weight of the machine is due to structure. In this paper FE analysis of headstock is carried out for the specific cutting condition i.e. turning operation. Here, we prepared a headstock model in pro-E 4.0 software. Based on mathematical calculation values of cutting forces, and thrust forces are used in FE analysis. Here, we used ANSYS WORK BENCH 11.0 software for the FE analysis of the head stock (Machine tool structure). Through this analysis we get the result in terms of stresses and deformation and this result are within the allowable limits.

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