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"A REVIEW ON COMPARATIVE DESIGN & OPTIMIZATION OF FG300 & SG350/22 MATERIAL USED FOR ROTARY TABLE PALLET"

Mr. Shridhar S. Patil [1],Mr. Aashay S. Udagave[2],Mr. Pravin P. Patil[3],Mr. Pruthviraj P. Nikam[4]

U.G.Student of MechanicalEngg, PVPITSangli - Vita Road, Budhgaon, Sangli, Maharashtra 416304

PradipVasantraoKadam

Guide,Asst.Professor, Mech. Engineering Dept, PVPITSangli - Vita Road, Budhgaon, Sangli, Maharashtra 416304

ABSTRACT : *This review proposes a replacement of existing pallet of RNA200 HMC machine. The existing pallet is of FG300 material which has machining problems due to its hardness and complicated microstructure. This review paper has an attempt to optimize existing pallet regarding its design and material. This paper focuses on removal of machining and geometrical complexity. Our attempt is to use SG350/22 material for modified pallet with optimized design.*

KEYWORDS:- FG300,SG350/22,pallet,optimization

1.INTRODUCTION

CNC rotary table is an important attachment employed to enhance the productivity of a CNC machining centre. It is a work holding device on a machining centre not only used to position the components in any desired position but also carry out machining on different faces of the component. A CNC rotary table of size 200 mm diameter has to be designed to hold as well as support components. Force acting on the table is work piece weight and Jigs and fixtures ie 900 N and machining force of 15000 N.

The rotary table should be designed with positional accuracy of ±10 seconds .

Pallet is a work supporting, holding and mounting device used in rotary table and in automatic pallet changer to enhance the operation of a CNC machining center. Pallet supports and transmits all the forces to the base of the CNC machine. Hence pallet is the most censorious component and has greater effect on machining accuracy. This work focuses on the design and weight optimization of pallet by changing the material configuration of pallet .Further optimized pallet with is checked for resonance within the operating speed of the machine to enhance the interpretation and rendition of pallet.

An Optimization of pallet weight is an important aspect to be considered for better productivity, effectual manufacturing and cost deduction . An effort for optimization of pallets has been carried out by many researchers using various methods considering static& dynamic loading conditions. The maximum deflection & stress developed within the permissible limits.

Pallets are generally used in storing heavy and large items in different industries throughout the world . Reason for using pallet is to ensure material handling, proper operation, enhancing accurancy and storage of the material. Wood is commonly used for making pallets; but from view of todays environmental condition wood is not best

choice for pallets. In this research a pallet is designed and analyzed by comparing various material like FG300 & SG350/22 on ANSYS respectively. Analysis is done by considering uniformly distributed static force on pallet. From the results obtained from analysis done on pallet using ANSYS suggests which one is best from point of less deformation in shape.The material for the pallet is FG 300. It is the grade of cast iron with ultimate tensile strength of 300 MPa and rest of mechanical properties are listed below.

SG iron has high plasticity and good toughness, the tensile strength of ductile iron is 414 Mpa and the yield strength of SG Iron is 276 Mpa, it can be comparable to carbon steel in strength. So it is often used to produce iron parts which require high strength, toughness and complex shapes

and rest of mechanical properties are listed below.

Sl No	Property	Unit	SG350/22	Fg300Value
1	Density[ρ]	Kg/m^3	7100	7250
2	Modulus of Elasticity[E]	GPa	65.9	116
3	Poisson's ratio[γ]	NA	0.275	0.29
4	Ultimate Tensile Strength[σu]	MPa	350	298
5	Compressive yield strength	MPa	181	972
6	Hardness	H_B	160	180
7	Shear modulus[G]	GPa	169	54
8	Specific Heat	J/kg°c	$0.461x10^{-3}$	0.530×10^{-3}

Table-1: Property Table

2.RELEVANCE

Rotary table accompanies of many parts like circular steel plate, spindles, a drive system, and pins that hold parts in proper place.Selection of rotary tables necessary an analysis of specifications and features. It contains maximum indexing increment, torque, rotational speed obtained at the table top, maximum axial load, maximum applicable maximum radial load, machining force, work table diameter. Computer numerically controlled (CNC) devices provide greater accuracy and repeatability.

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Due to its spheroidal shape in microstructure the obstruction to the machining are minimized. Graphite present in SG also acts as a lubricant to machine tools during cutting. Due to these properties of SG350/22 machining cost and also time required for machining is considerably reduced.

3.LITERATURE REVIEW

3.1 B santoshkumar et al[1].This paper focuses on a CNC rotary table of size 500 x 500 mm has to be designed to support and hold components weighing up to 8000 N for machining. The rotary table should have the positional accuracy of ±10 seconds with a rotational speed of 30 rpm. This work mainly focus on the selection and design of critical components like worm gear ,servomotor, mechanism, worm gear support bearings , table support bearings,bellow coupling, angle encoder and lock nut for preloading the bearings to meet the requirements of the rotary table.

3.2 B.Malleswara Swami, et al[2], In this paper, the complete analysis of a machine bed is selected for both static and dynamic loads. The efforts are carried out to reduce the weight of the machine bed without deteriorating its accuracy and itsstructural rigidity of the machine tool by adding ribs at the suitable locations.

3.3 S. Syathabhuthake, et al[3], This paper 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 verify 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 and numerical analysis was in order to 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.

3.4 V.J.Panchal, et al [4].The paper focuses rotary indexing mechanism which is used for getting angular motion in required time. Single setup concept will increase productivity with cost effectiveness and consistent accuracy.

3.5 Ryuta SATO etal[5]This paper deals with a mathematical model of CNC rotary table driven by a worm gear. In this study, a mathematical model which can simulate dynamic behaviors of rotary table is proposed. The model consists inertia of motor, spur and worm gears, and table. Various motions are measured and simulated to fix effectiveness of the model. Finally conclude that the proposed model can simulate step response, rotational fluctuations, and influence of unbalanced mass.

3.6 VikramAvhad, et al [6] The main purpose is the design and weight optimization of pallet by changing the existing geometry of pallet .Further optimized pallet which is checked for resonance within the operating speed of the machine in order to improve the fatigue performance of pallet. Structural static analysis of the present and modified pallet will be carried out with finite element software and results will be compared for deflection and stresses.

3.7 O Karacali, et al [7], The aim of this research was to construct a nailing model based on the shape and material of the prepared nail pallet joint. The nail was presented as height h = 60 mm, corresponding with thickness of pallet. The result of numerical analysis was determination of strains and stresses in working part of the nail pallet. Effects of analysis indicate diverse values of strains and stresses distribution in working part of the nail pallet depending on its geometry. The numerical analysis of the operational nail pallet joint system is basis for optimization of cutting edge geometry of joining tools as well as for election of their mechanical properties and suitable materials. The conclusion of this analysis are helpful for pallet design engineers for material selection material handling interest.

3.8 Funaru Marian, et al [8], This paper emphasis a new technical solution of the index table mechanism used on multi-axis machining centers, which significantly helps reduce the auxiliary time in the manufacturing process. The mechanical structure of the table mechanism described in
this paper gives the chance to obtain a very high positioning precision, using a curvic coupling and a hydraulically driven table clamp/unclamp mechanism.

3.9 Abdullah Waseem, et al [9]This paper conclude that a PVC made pallet are developed and analyzed for the uniformly distributed static load on pallet by using the Pro-E and ANSYS packages further deformation and stress developed in the pallet are compared with the other material pallet.

3.10 Shrinivas B. Patil, et al [10], This paper offers a new technical solution of the index table

mechanism used on multi-axis machining centers, which significantly helps reduce the auxiliary time in the manufacturing process. The mechanical structure of the table mechanism described in

this paper offers the possibility to obtain a very high positioning precision, using a curvic coupling and a hydraulically driven table clamp/unclamp mechanism.

3.11 CONCLUDING REMARK FROM LITERATURE REVIEW:

This shows that many authors [1-10] have reported the pallet design for rotary table and also analyzed the pallet for different loading and working conditions. Now available or existing pallets are of gray cast iron but still there doesn't exist any focus on suitable different material selection with changes in external geometry of while designing for the rotary table.

4.PROPOSED WORK

The proposed work aims at developing a pallet design which is suitable for rotary table, optimizing the weight & there by selecting SG350/22 Iron material for better mechanical properties , for good casting & machinability without lowering its strength.

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