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Automatic Loading & Unloading CNC turning Centre DX 200

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***Abstract*— Manual work on CNC is normally done. Manual loading & unloading is time consumable & require manpower. Normally workers pick the component than load into the chuck & after the completion of operation unloads the component & place at require place. So it will take time to complete the cycle. In order to reduce the cycle time automation comes into play. By using robotics we can load & unload the components, which in turn reduces the cycle time & also require less labor work. So, we compare the cycle time which takes place in manually & in automation & make the model on SOLIDWORKS. Hence we can achieve the goal to reduce the cycle time & increase the productivity.**

***Index Terms*—Automation, Pick & Place Unit, Loading unloading the component, Robotics.**

I. INTRODUCTION

Automation is termed as use of different control systems such as numerical control, programmable logic control or other industrial control systems in concern with computer applications or information technology(such as Computer Aided Design or Computer Aided Machining) to manipulate all the industrial machinery and processes, thus reducing the need for human intervention. As always said, for growth of industries, automation is must and should supersede the mechanical growth. Where mechanization provides human operators with machinery to assist them along with the muscular requirements of work, automation decreases the involvement for human sensory and mental requirements as well. Automation plays a dominant role in the world economy these days and in daily application in industries. As for these days, the twenty first century engineers are increasing their research to combine automation with mathematical and organizational systems to facilitate new complex systems which has wide applications. Pick & Place robot is used in a wide variety of material transfer applications. Basically, the machine takes a product from one spot in the manufacturing process and places it into another location. A good example is a robot picking items off a conveyor belt and placing them into packaging boxes. The typical pick and place application requires high amounts of repetitive motion. Robots can eliminate human operation of hazardous tasks such as chemical spraying or heavy lifting. Pick and place robots have high return on investment when consistent shaped parts or containers are handled. Unlike human operators, robots also have the ability to work for an extended time.

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The main exploration in this project is about robotics project including a description of the recently programmed behaviors. The reports begin with an overview of the robot integrated system. It then continues with a description of the aspects of the robot; including robotic arm mechanisms their motor and servo actuators.
Pneumatic systems form the most primitive and distinct class of mechanical control engineering. They are classified under the term 'Fluid Power Control', which describes any process or device that converts, transmits, distributes or controls power through the use of pressurized gas or liquid. When high-pressure liquids (like oil) are used to transmit power, the system is termed as hydraulics. In a pneumatic system the working fluid is a gas (mostly air) which is compressed above atmospheric pressure to impart pressure energy to the molecules. This stored pressure potential is converted to a suitable mechanical work in an appropriate controlled sequence using control valves and actuators.

A. CNC Pick and Place Unit Consist of Below Mentioned Part:-

1) Pneumatic Cylinder(Loading New Component into Loading Station) :- 40 MM (BORE) X 20 MM (STROKE)
2) Pneumatic Cylinder(Loading Cylinder) :-100 MM (BORE) X 600 MM (STROKE)
3) Pusher Pneumatic Cylinder:- 32 MM(BORE) X 40 MM (STROKE)
4) Unload Pneumatic Cylinder from CNC Turning Centre:- 32 MM(BORE) X 40 MM (STROKE)
5) Catcher Pneumatic Cylinder :- 40 MM (BORE) X 500 MM (STROKE)
6) Door Open and Close Pneumatic Cylinder:- 63 MM(BORE) X 500 MM(STROKE)
7) M.S Frame
8) Two Jaw Mechanical Gripper
9) Teflon Spacers

II. FE ANALYSIS OF FRAME

A. Define Fixed Support

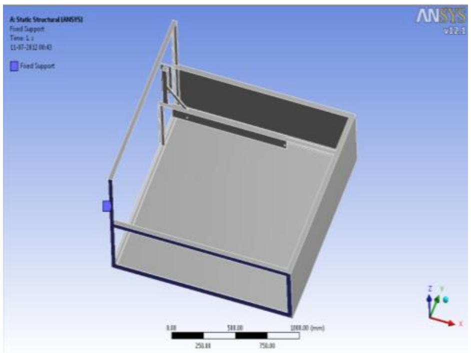

Figure. Fixed Supports

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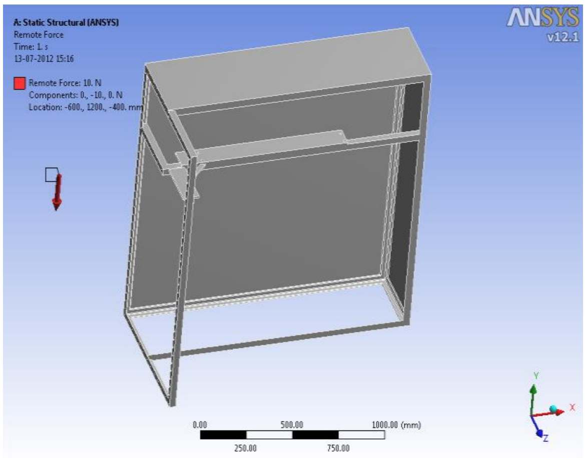
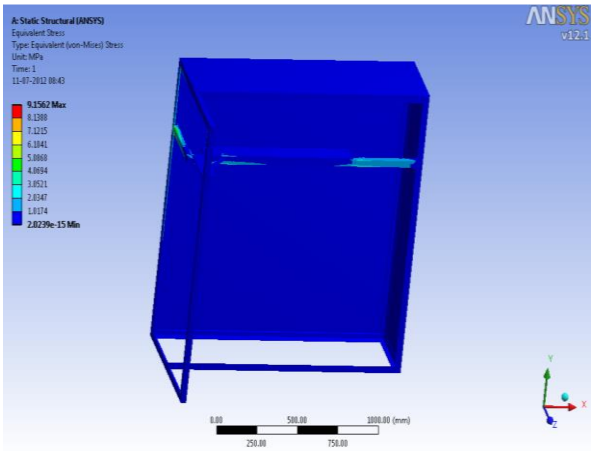
B. *Define Remote force for work piece*



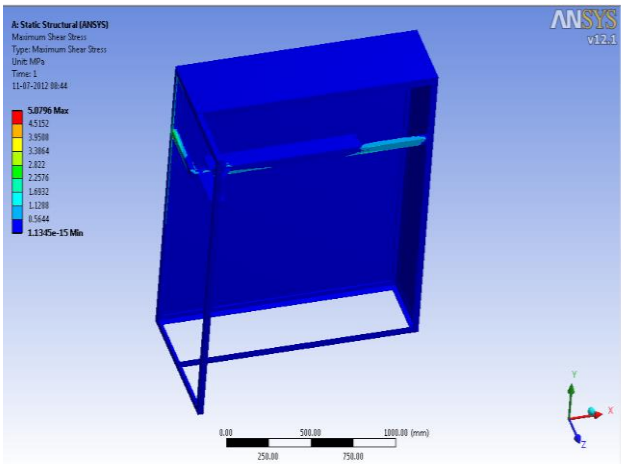
III. STATIC ANALYSIS OF FRAME

A. *Von Misses Stresses*



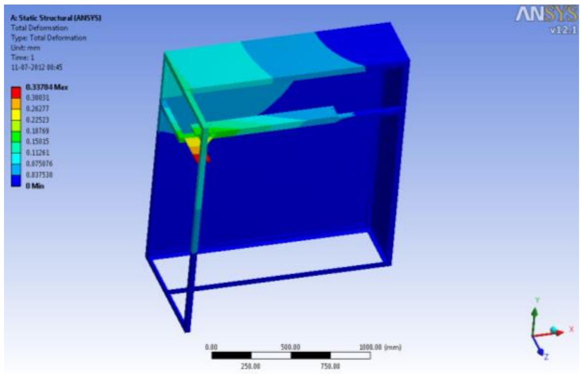
Generated Von Misses Stress: - 9.1562 MPa
Factor of Safety for Design:- 5
Permissible Von Misses Stresses for material (steel): - 190/5:- 38 MPa
From Above results we can say that generated Von misses stresses is less than permissible von misses stresses. So Our Design is Safe.

B. *Maximum Shear Stresses*



Generated Maximum Shear Stresses: - 5.0796 MPa

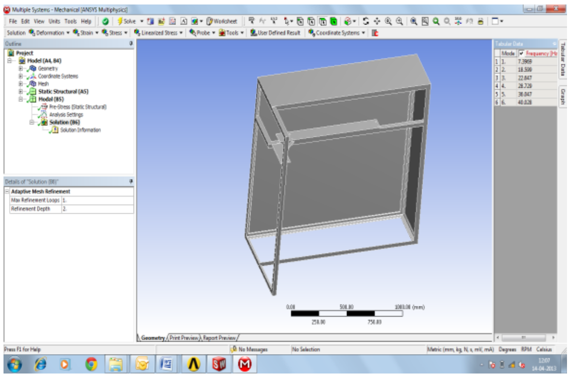
C. *Total Deformation*



Generated Total Deformation: - 0.33784 mm

IV. MODAL ANALYSIS

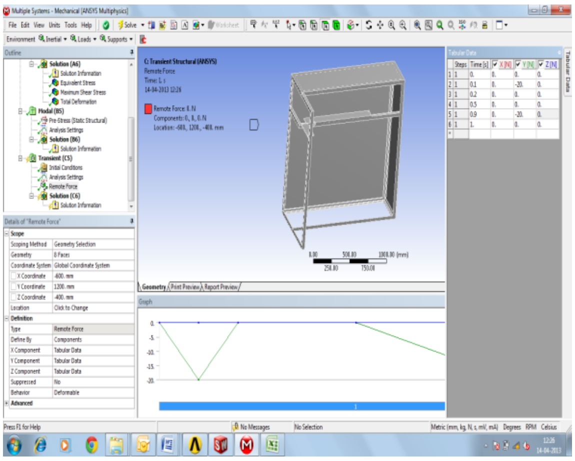
A. *Natural Frequencies of Modal Analysis*



Sr No.	Modal Frequency(Hz)
1	7.3969
2	18.599
3	22.647
4	28.729
5	36.047
6	40.028

V. TRANSIENT ANALYSIS OF FRAME

A. *Define Remote Transient Load for Picking and placing the component*



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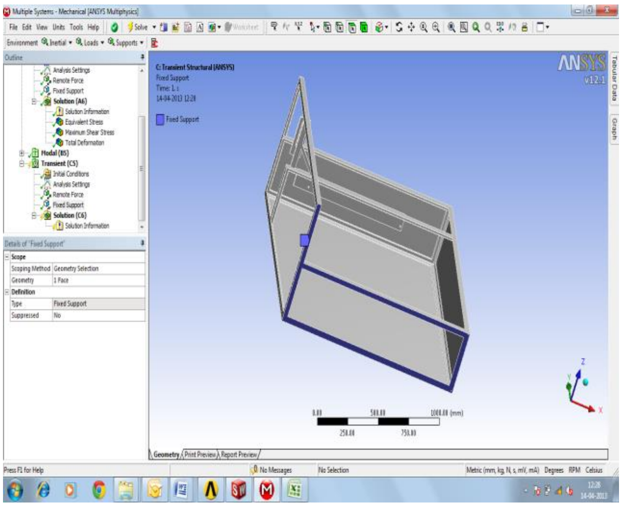
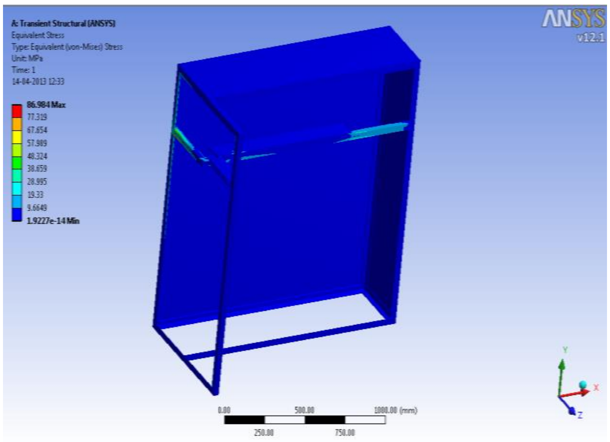
B. *Define fixed Support for Transient Analysis*

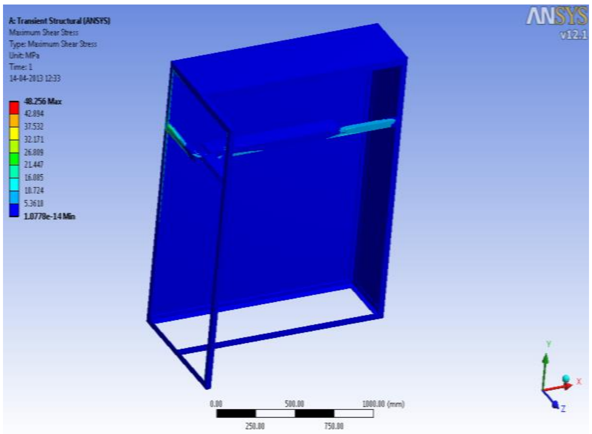


VI. RESULT OF TRANSIENT ANALYSIS

A. *Equivalent Stresses*



B. *Maximum Shear Stresses*



From above generated Equivalent and Maximum Shear Stresses, We can say that this Design is Safe from Static and Dynamic point of View and there are chances of Optimization of Pick and Place Unit Frame.

VII. OPTIMIZATION PROCESS

A. *Outline of Optimization Process*

The shape optimization of components in dynamic mechanical systems requires several quantities. These quantities are to be derived in every iteration of the optimization process. They result from various types of analyses and the optimization process is obtained by a combination of these analyses. Figure 1 outlines the stages with respect to the order in which they are carried out during the batch process. In the following section some basic aspects of each step of the process shown above are described in more detail in order to provide the reader with the necessary background for all analysis domains involved.

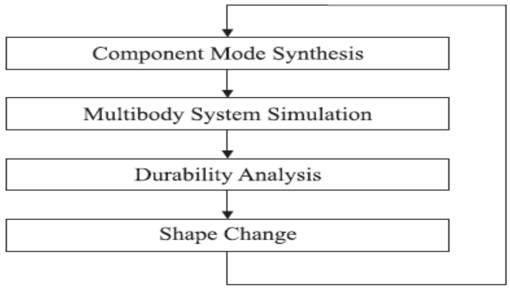


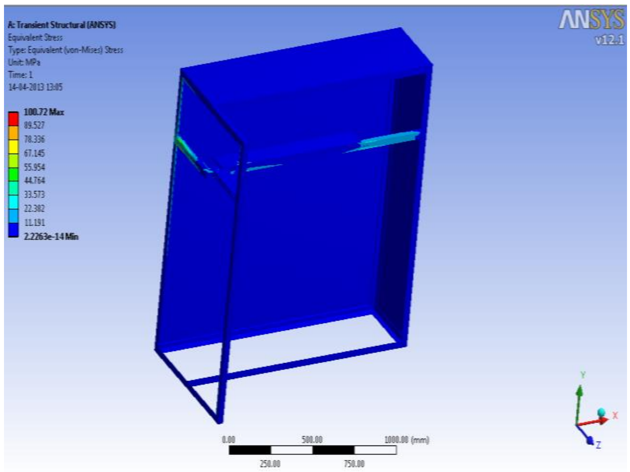
Figure.Stages of Optimization Process

ORIGINAL MODEL: - 35 X 35 X 5 mm

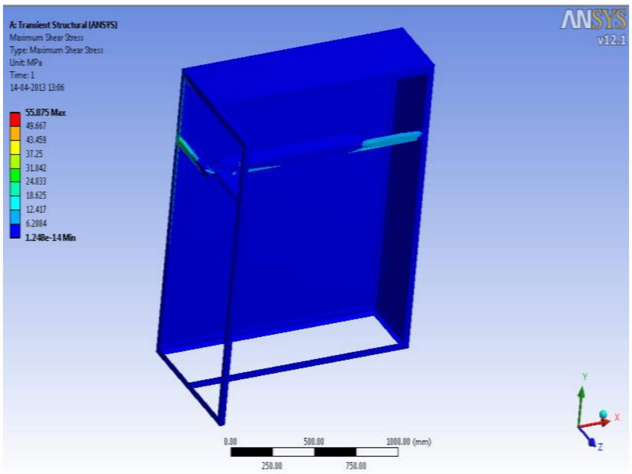
VIII. MODIFICATION 1

30 X 30 X 4 mm Structure

A. *Von Misses Stresses (Equivalent)*



B. *Maximum Shear Stresses*



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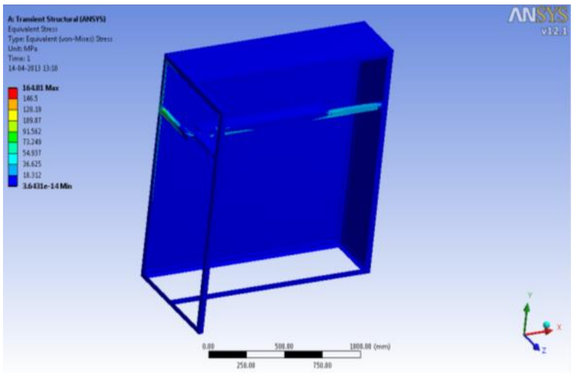
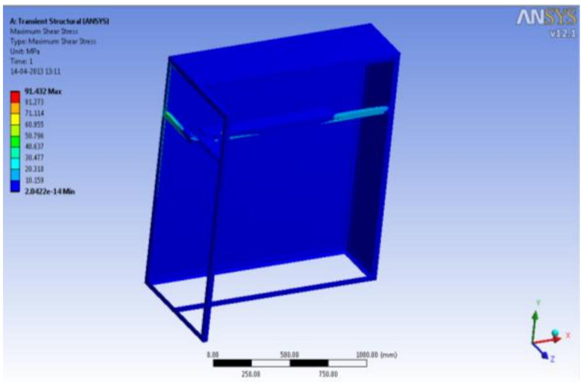
IX. MODIFICATION 2

25 X 25 X 3.5 mm Structure

A. *Von Misses Stresses (Equivalent)*



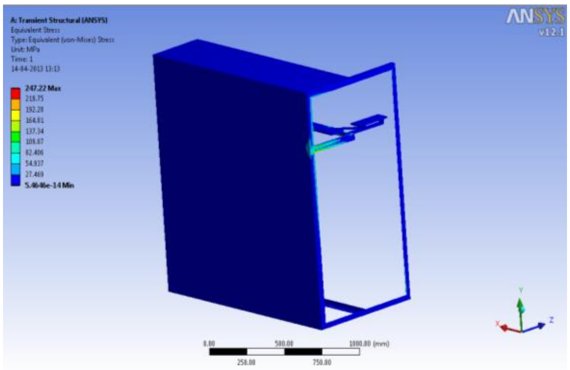
B. *Maximum Shear Stresses*



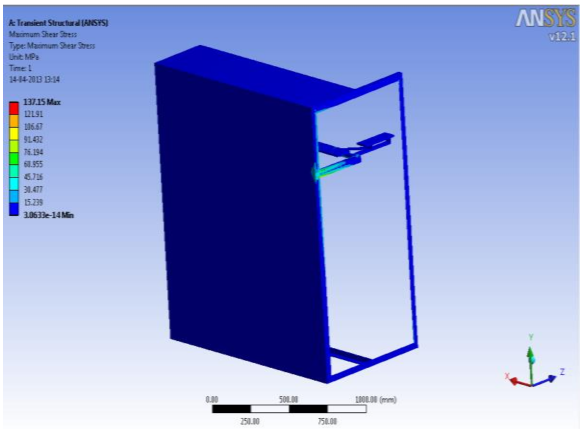
X. MODIFICATION 3

20 X 20 X 3 mm Structure

A. *Von Misses Stresses (Equivalent)*



B. *Maximum Shear Stresses*



XI. CONCLUSION

A. *OPTIMIZATION TABLE*

	MODI. 1	MODI. 2	MODI. 3
	30 X 30 X 4	25 X 25 X 3.5	20 X 20 X 3
VON MISSES STRESSES (Mpa)	100.72	164.81	247.22
MAXIMUM SHEAR STRESSES (Mpa)	55.875	91.432	137.15
WEIGHT(Kg.)	213.87	197.1	188.62

Above Table Shows that Generated Stresses in Modified 2 Frame is below the material Allowable Limit (Von Misses Stresses = 200 Mpa).

So Modified 2 Frame is optimum configuration for CNC Pick and Place Unit

REFERENCES

[1]. Design and hybrid control of the pneumatic force-feedback system for Arm-Exoskeleton by using on/off valve Chen Ying, Zhang Jia-fan , Yang Can-jun, Niu Bin.The State Key Laboratory of Fluid Power Transmission and Control, Zhejiang University, Hangzhou 310027, PR China.

[2]. Development of pick & place Robot, Mohd Hishamudin B Shaharom, University Kuala Lumpur (NOVEMBER 2011).

[3]. Flexible kinematics for modular robots, K N Tarchanidis, A S Mackay and J Lucas.

[4]. The structure design & kinematics of robot manipulator, Kesheng Wang & Terje K.Lien, Production Engineering Laboratory, NTH-SINTEF, N-7034 Trondheim, Norway.

[5]. Mathematical modelling, simulation and experimental verification of a scara robot M. Taylan Das, L. Canan Dulger Department of Mechanical Engineering, University of Gaziantep, 27310 Gaziantep, Turkey (2005).

[6]. Solidworks software

[7]. ANSYS V 12.1

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