Design and Analysis of Strip and Block Clamping Machine

Ankit A. Dahake[1] and Prof. R.Banpurkar[2]

[1] MTECH Student of Mechanical Engineering Department
Abha Gaikawd Patil College Of Eengineering, Nagpur, Maharashtra, India
[2]Assistant Professor Mechanical Engineering Department
Abha Gaikawd Patil College Of Eengineering, Nagpur, Maharashtra, India

Abstract: *Automation is the conversion of a work process, a procedure, or equipment to automatic instead of human operation or control. Automation doesn't transfer human functions to machines, it involves a deep reorganization of the work process, during which both the human and the machine functions are redefined. Early automation relied on mechanical and electromechanical devices; during the last forty years, however, the computer gradually became the leading vehicle of automation. Modern automation is usually associated with computerization.*
This study deals with the design and development of strip and block clamping machine used to clamp the work piece. In this project we will be creating CAD model of the Strip and block clamping machine and performing FEA on strip and block clamping machine will assist us to know the stresses and displacement on the machine while in operation for its enhancement and development of the process with semi automation.
Keywords: *semi automation, FE Analysis, Design, Clamping.*

I.   Introduction

Automation may be a set of technologies that results in operation of machines and systems without significant human intervention and achieves performance superior to manual operation. Automation Systems are essential for most modern industries. It has been achieved by various means that including mechanical, hydraulic, pneumatic, electrical, electronic devices and computers, typically together.

Earlier the aim of automation was to extend productivity (since automated systems can work 24 hours a day), and to reduce the price related to human operators (i.e. wages & benefits). However, today, the main target of automation has shifted to increasing quality and flexibility in a manufacturing process. In the industry, the installation of pistons into the engine used to be performed manually with an error rate of 1-1.5%. Presently, this task is performed using automated machinery with an miscalculation rate of 0.00001%.

Advantages of Industrial Automation:

• Industrial automation eliminates care prices and paid leave and holidays related to human operator. Further, industrial automation doesn't need other employee benefits such as bonuses, pension coverage etc. Above all, though it is related to a high initial price it saves the monthly wages of the workers which leads to substantial cost savings for the company. The maintenance cost related to machinery used for industrial automation is smaller amount as a result of it doesn't usually fail. If it fails, only computer and maintenance engineers are needed to repair it.

• Although several companies hire many production workers for a up to three shifts to run the plant for the maximum number of hours, the plant still must be closed for maintenance and holidays. Industrial automation fulfills the aim of the company by permitting the company to run a manufacturing plant for 24 hours in every day, 7 days in every week and 365 days a year. This leads to a significant improvement within the productivity of the company.

• Automation alleviates the error related to a human being. Further, unlike human beings, robots don't involve any fatigue, the products with uniform quality manufactured at different times.

• Adding a replacement task within the assembly line requires training with a human operator, however, robots will be programmed for doing any task. This makes the manufacturing process more flexible.

• Adding automatic data collection, will enable you to gather key production data, improve data accuracy, and reduce your data collection costs. This provides you with the facts to create the correct decisions when it comes to reducing waste and improving your processes.

• Industrial automation can build the production line safe for the staff by deploying robots to handle dangerous conditions.

II. Aim And Objectives

The objective of this dissertation is to Design and Analyze the Strip and block clamping machine to semi automate the current process of clamping. The objectives are:-

• To automate the strip and block clamping process.
• To generate the CAD model of metal strip and block clamping machine.
• To perform design and analysis of metal strip and block clamping machine.
• To enhance the production rate of company by using metal strip and block clamping machine.
• To improve quality, flexibility , accuracy and safety of the process.
• To minimize errors as well as time required for the process.
• To implement semi skilled labours to the work and save manpower cost.

III. Literature Review

Marko Krsulja, MijicSasa, Branimir Barisic, Zlatan car [1] This paper is based on the design and planning of clamping work holder station for sheet metal part .Technology that supports a collaborative product manufacturing is proposed, developed and implemented in this study. A method of digital planning, based on setup planning and work-holding selection in three dimension (3D) space was used for clamping of two sheet metal parts of a car body part. With accurate simulation and analysis it is possible to influence and resolve spatial conflicts and other negative behaviors necessary for positioning and securing of complex shapes made from sheet metal plates. Complexity of given product is analyzed and a solution proposed for a work holding station for the selected manufacturing system. Modelling was preformed with Catia software. Interaction design knowledge about the characteristics of the environment and operator has also been included in the design.

Tushar Jain and Meenu [2] This paper is based on the automation and integration of industries through computer vision system . In this application, the computer vision system scans manufactured items for defects and provides control signals to a robotic manipulator to remove defective parts automatically. Current examples of medical systems being developed include: systems to diagnose skin tumors automatically, systems to aid neurosurgeons during brain surgery, systems to perform clinical tests automatically etc. The aim of this paper is to show some of the most important vision-related topics which can have a more or less direct impact on the machine vision and industrial automation research fields. The paper covers a general purpose computer or machine vision systems with its industrial applications.

Manish Shrivastava, Prof. Jaikaran Singh and Prof.Mukesh Tiwari [3] In this research article, a comprehensive approach toward industrial automation has been taken. Several methods were evaluated on the basis of cost and performance. In addition to that a new system based on Control Area Network has also been discussed. The proposed system is under development and GUI (graphical user interface) for the same has to be developed. Also all the technological solutions have been discussed keeping in view Indian scenario and development state in our country. Despite years of activity, truly open and intelligent control systems seem still to be a promise of the future. Agreement on common architectures and application objects is needed to raise open control systems from exchanging raw data to the level of real interoperability of off-the-shelf components. Future control platforms and programming languages should have new built-in mechanisms that support implementation of intelligent functions, such as flexible resource management and exception handling. This article argues that many of these challenges can be met by taking full advantage of emerging software engineering technologies. This also means that the modeling techniques and design practices of software engineering should be combined with the traditional ways of thinking in automation.

Mirza Jahanzaib, Syed Athar Masood, Khalid Akhtar, Fahad Al Mufadi [4] this paper is focused on multi station automated system which is employed for operational performance of the assembly operations. Standard mathematical routines have been modeled and analyzed using real life industrial data engaged in assembling of products in high technology industry. A comparison of these functions allowed users to identify sensitive process parameters affecting the system. It has been learnt that yield related parameters are the most sensitive in the automated system followed by the cost and process cycle time. The automated assembly systems are designed to perform the assembly operations in a fixed sequence to assemble products. Four types of system/operational planning issues are significant which are: delivery of parts at workstations; single station system; multi-station automated systems; and partial automation.

Gaurav Bhusari [5] Automation The present proposed work in this paper aims at developing the easy to machine fixture which not only enhances the production rate but also reduces machining time. Presently in automobile industry, the production line for engine assembly is done in conventional method, due to which

production takes too much time to produce a product. Sometimes it doesn't fulfill the demand due to lack of production technique and delays. We have proposed a design of a fixture bracket which will be very useful for production of engine in production line. With the help of this fixture bracket, the assembling of the engine block with its sub-parts will be quite easier than the conventional method. Also we calculate the strength equations and fatigue analysis on the fixture bracket for the safety of the operator and production system.

E. E. Jumbo [6] The study has considered the fundamental calculations in the design of revolving clamp assembly; which in any standard manufacturing environment is not only critical but dependable. This implies that the revolving clamp assembly is a very important work tool in any well-equipped workshop. The characteristics of this clamp compare well with the intended purpose of its design. Many types of clamps exist with limited scope of use and application; but the revolving clamp applies some flexibility for which a particular workpiece could be positioned and worked upon from different angles. The study also conducted a calculation of the stress capacity of the revolving clamp assembly, where it observed that the surface or stress area of a clamp device plays a crucial role its work holding capability. The yield stress was also determined alongside its bending and crushing stress.

Andrea Mudrikova, Karol Velisek and Peter Kostal [7] Present situation in the industrial manufacture has brought new trends in the kind of flexibility and intelligence. That means new generation of intelligent manufacturing systems. New generation of clamping fixtures is represented by group of clamping fixtures which can be used in intelligent manufacturing systems. Important effect, which brings manufacturing times shortening, can be realized by automation process of manipulating and fixture operation. This effect can be also realized by some intelligence degree of whole clamping system. Using of new generation clamping fixtures can lead to the important manufacturing process effectiveness increase, as well as, quality increase.

IV. Identified Gaps in the Literature

Many researchers have presented their work on design and development of special purpose assembly machine considering limited parameters, calculations on mechanism, was also observed during our study. Very limited and small amount of work for design and analysis for strip and magnet clamping has been observed and there is still a need for further work. Understanding the problems this work is mainly focused on design and analysis of strip and magnet clamping machine.

4. Plan of work
1) Data accumulation.
2) Literature survey.
3) CAD modeling of Strip and Block clamping machine.
4) Analysis of Strip and Block clamping machine in FEA.
5) Result discussion.
6) Finalization of the design.
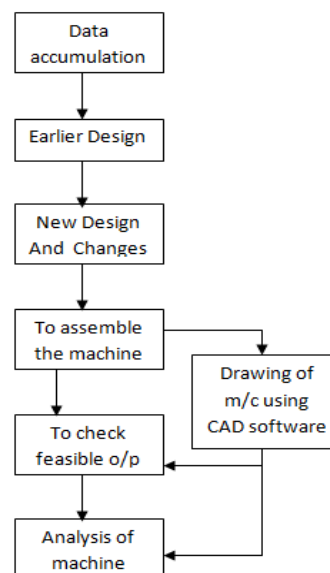
V. Research Methodology

All design data related to the dimensions, material and forces acting on strip and Block clamping machine, etc will be fetched from the company. With the help of measuring devices, all the essential measurements will be taken to generate CAD design of the strip and Block clamping machine. As per design data obtained, a CAD model of machine will be generated by using CAD software SOLIDWORKS. A finite element model of machine will be generated using CAD model in hyper mesh. As per geometry dimensions suitable element configurations will be used for meshing. A modified CAD model of clamping machine will be generated if required by using CAD software SOLIDWORKS. A finite element model of modified design will be performed and comparative study of the result will be carried out. To draw out the conclusion.

VI. Conclusion

As per the requirement Semi-Automated clamping machine will be designed with collected detail data. The existing use of the mallet need will be replaced with an automated machine which can overcome the uneven forces being applied to strip and block parts. On the basis of objective, data accumulated and design calculations a cad model of Semi-Automated clamping machine is will be modelled.

References

[1]. Marko krsulja, "Design and Planning of Clamping Work-holder Station for Sheet Metal Part of Car Body" Manuf. and Ind. Eng., 11(2), 2012, ISSN 1338-6549.

[2]. Tushar Jain, "Design and Integration of Industries through Computer Vision Systems" International Journal of Information and Computation Technology Volume 3, Number 9 (2013), pp. 963-970.

[3]. Jaikaran Singh, "A Industrial automation – A Review" International Journal of Engineering Trends and Technology (IJETT) – Volume 4 Issue 8- August 2013.

[4]. Mirza Jahanzaib, "Performance Analysis of Process Parameters Effecting the Automated Assembly System" Life Science Journal 2013;10(1).

[5]. Gaurav Bhusari, "Design and Analysis of Fixture Bracket for Engine Assembly Line" IJIRST –International Journal for Innovative Research in Science & Technology| Volume 2 | Issue 05 | October 2015.

[6]. E.E. Jumbo, "Sequence Modeling and Calculations in the Design of Revolving Clamp Assembly" IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE), Volume 10, Issue 6 (Jan. 2014), PP 34-38

[7]. Andre mudrikova, "Clamping Fixtures Used for Intelligent Assembly Systems" 2009 International Symposium on Computing, Communication, and Control Proc .of CSIT vol.1 (2011)

[8]. J. Krugar, "Cooperation of human and machines in assembly lines" ScienceDirect CIRP Annals - Manufacturing Technology 58 (2009) 628–646.

[9]. L.L Faulkneret, "Design of Automatic Machinery" mechanical engineering A Series of Textbooks and Reference Books