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C.A.E OF WORK ROLL CHOCK AND BACKUP ROLL CHOCK OF COLD ROLLING MILL

Snehal Nemade[1], D.D. Baviskar[2], G.M. Lonare[3]

[1]M.E. Scholar, [2]Assistant Professor, [3]Associate Professor
BVCOE Kharghar Mumbai (India)

ABSTRACT

A rolling process is a metal forming process in which metal stock is passed through one or more pairs of rolls. The metal changes its shape i.e. reduction in thickness amid the period in which it is in contact with the two rolls. The main use of rolling processes is in mechanical working processes. A Rolling mill is a complex machine for distorting metal in rotary rolls and execution various operations such as transference of stock to rolls, disposal after rolling, cutting, cooling, melting. The issue of failure of rolling mill chock was there in industry, which can be effectively determined by incorporating the designs with computers.

The present work includes the design optimization of working roll chock and backup Roll chock in cold rolling mill, to control the failure of chock in cold rolling mill to minimize the material cost and longer existence of the roll chock. The stress distribution of the roll chock had been analysed by software ANSYS from which maximum static stress at critical areas have been calculated. To forecast structural behaviour of Roll chock under the given boundary conditions and loading using an analytical model are very difficult. Therefore model was chosen in order to predict the stress and deflection response details by using ANSYS 14.5

I. INTRODUCTION

Rolling is characterized as a process in which metal is shaped through a couple of spinning moves with plain or furrowed barrels. The metal changes its shape bit by bit amid the period in which it is in contact with the two rolls. Rolling is a noteworthy and a most generally utilized mechanical working method. A Rolling mill is an unpredictable machine for deforming metal in rotating rolls and performing assistant operations, for example, transportation of stock to rolls, transfer in the wake of moving, cutting, cooling and liquefying.

Chocks are the highest stressed component in a manufactured item, and so are most susceptible to invariable the financial losses incurred as a result of chock failure will be far greater than the actual value of the chock instantiated delivery of chocks because of manufacturing pre-setting failure could stop a production failure at the assembly stage is almost certain to halt production if only one or two chocks out of a large batch tailback no manufacturer would willingly assemble goods that are suspecting failure in serviceable the most catastrophic consequences example failure of cold rolling mill chock is very likely to result in the complete destruction of the cold rolling mill. Disappointment of chocks in a cold rolling mill is fundamentally on account of higher stresses created at the start up and close down state of rolling mill so for an outline of chocks for an icy moving plant it is key to know the most extreme load following up on a chock to keep it from a failure due to cyclic stacking, is likewise a criteria of chock design. Second most essential function of to fill in as an isolator, so design of chock likewise has an obliged solidness to transmit a vibration from a source to receiver. So while designing a chock for cold rolling mill two factors is very essential i.e. strength of chock to sustain a maximum load and deflection of the chock should be minimum.

II. LITERATURE SURVEY

Amid the writing review it is found that numerous specialists had chipped away at the moving plant and its parts. Numerous creators have dealt with moving factory lodgings, outlining of lodging, Manufacturing of moving plant outlines, moving rolls. Numerous segments are upgraded for their working. Enhancements are likewise accomplished for the warmth dissemination in moving moves, distortion preventions and fortifying for the work rolls. Some creator has taken a shot at the vibration in moving plant and the moving rolls and weight on moving factory lodging. For the controlling of moving velocity numerous models have grown, however it is found that the segment like Chock of moving plant is still not considered for research work so it is choose to deal with the moving chock for the basic investigation.

For the duration of the literature survey it is determined that many researchers had worked on the rolling mill and its components. Many authors have worked on rolling mill housings, designing of housing, manufacturing of rolling mill frames, rolling rolls. Many components are optimized for his or her functioning. Optimizations are also performed for the heat distribution in rolling rolls, deformation preventions and strengthening for the work rolls. a few writer has laboured on the vibration in rolling mill and the rolling rolls and stress on rolling mill housing. For the controlling of rolling speed many fashions have advanced, but it is located that the issue like Chock of rolling mill is still no longer taken into consideration for research designs so it is decide to design at the rolling chock for the structural analysis.

Snehal Nemade[1]proposed the review of the use of Finite element evaluation the weight of chock may be lessen without affecting the existence cycle of the rolling mill housing. The rolling chock may be design by using applying computer Aided layout and Engineering method for rolling housing mill and stress generated at the surface of chock.

U.S.Dixit[2] proposed a systematic design procedure for a rolling mill designed by authors. The rolling mill has been fabricated and is functioning in the manufacturing laboratory of the institute. Performance of the mill is quite satisfactory. Since the design procedure is formal and well recorded, all the decisions can be examined and appropriately modified to give a revised design in a different situation. It is expected that the guidelines presented here are form a basis for industrial design of metal forming equipment in general and rolling mill in particular.

Vinod D.Tirpude[3] proposed that as the load is increased in the components of rolling mill, conversely the reactions in the bearings increases. This increase in reaction of a bearing is then responsible for increase in amplitudes at corresponding frequencies of components.

PériclesGuedesAlves[4] proposed the model deduced right here is tailored for manage, useful for studies and researches on new manage techniques applied to tandem mill. The obtained effects are coherent and robust to layout parameters. The versions because of the enter disturbances have small amplitude and the linearized version appeared ok. The technique achieve a modeling process for tandem cold metallic rolling, inclusive of the linearization step and device identification for manipulate. The tandem bloodless rolling manner is described by using a mathematical version based on algebraic equations developed for manipulate purposes and empirical relations. A state-area version is derived and specified analyses in open loop are supplied, regarding the sensitivity with regard to the versions in process parameters and consequences for the utility of a new subspace identification technique are as compared with classical methodologies.

N. Rabbah[5] proposed the two methods to calculate the thermal profile of work rolls. The thermal profile study of the work roll occurred in cold rolling is done by using physical bases and numerical developments. The perspective will be the development of a control law to reduce to the maximum the deformations of both the strip and the work rolls.

Devarajan et.al[6] proposed the 2-dimensional Elastic-plastic finite detail model to simulate the cold rolling of thick strip with different roll angular speed and roll diameter models is described. The angular speed of the rigid rolls ranged from 30 to 480 revolutions per minute (r.p.m.) and the inflexible roll diameter ranged from 100 to 300 mm. The method reap pace of the rolls and the diameter of the rolls have any have an effect on at the touch pressure and the residual stress in cold rolling system. The roll speed is an easily managed operational parameter which may be used to beautify the technique and the high-quality of the very last products with the aid of changing the curler diameter and notice the impact of strain and contact pressure at the thick plates strip is new one.

IMRE KISS[7] proposed the durability in exploitation is extraordinarily contemporary, both for fast practice, and for the medical research attributed to the cast-iron. additionally, the belief of top-rated chemical compositions of the solid iron can represent a technical efficient manner to assure the exploitation homes, the fabric from which the rolling mills rolls.

Alberto Bemporad[8] proposed the three different control techniques based on quadratic optimization and delay compensation for control of flatness in cold tandem mills. All three approaches provide good closed-loop performance with limited computation requirements. In particular the decentralized solutions proposed in the paper present a computational complexity which is linearly increasing with the number of stands.

H.J. Ter Maat[9] proposed the great part of the mice performance increase was obtained by the new automation, when restricted to the computer control. The computer control could be easily adjusted to the characteristics of the mill; the two control function i.e screw down control and tension limit control, illustrate methods to cope with the changing characteristics of the mill, the results of this controls are good.

III. SMART MATERIAL

3.1 Material for Existing Chocks

The Roll Chocks are manufactured with the aid of fabricating from forged steel or gray cast iron. In cast Iron Roll Chocks, minor welding restore is possible but important welding repair isn't always feasible to those solid iron Roll Chocks due to the fact the most important welding restore, huge amount of welding fabric is required. Three comparable metals are decided on for the chocks which can be of different value and extraordinary mechanical properties.

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Fe 410 material is used for production of sheets, chocks, Pump and valve elements and shafts. The unique chock is made up of Fe410 material.

3.2 Modelling of Existing Chock with Second Material (EN08)

A material of the present chock is Fe410. For the analysis purpose of the backup roll chock and work roll chock, a material have taken whose yield tensile strength and ultimate tensile strength (Sut) is decrease than the Fe 410. Consequently EN 08 material is chosen.

EN 08 material is used for manufacturing of coastal architectural paneling, railings, boat fittings, chocks. EN 08 material is comparable material of Fe 410.

3.3 Modelling of Existing Chock with Third Material (EN31)

A material of the existing chock is Fe410. For the analysis reason of the backup roll chock and work roll chock, a material have taken that's cutting-edge fabric within the marketplace whose yield tensile strength and ultimate tensile Strength (Sut) is better than the Fe410. Consequently EN 31 material is chosen.

EN 31 materials is used for manufacturing of sheets, blocks, chocks. EN 31 material is comparable cloth of Fe 410. EN 31 is alloy steel newly used for production chocks.

3.4 Motivation of Work

Failure of chocks in a cold rolling mill is essentially due to better burdened generated at some point of begin up and close down condition of rolling mill so for a layout of chocks for a cold rolling mill it is essential to recognize the maximum stress generated on a chock to save you from a failure like fatigue failure due to cyclic loading is also a standards of chocks design. second most vital characteristic of to paintings as an isolator case of cold Rolling mill additionally it has to carry out this characteristic, so layout chock maintain have a required stiffness to transmit a vibration from a source to receiver.

IV. HISTORY OF ROLLING MILLS

The earliest rolling mills had been slitting mills which have been added from what is now Belgium to England in 1590. Those surpassed flat bars between rolls to form a plate of iron, which turned into then surpassed between grooved rolls (slitters) to supply rods of iron. The primary experiments at rolling iron for tinplate took place about 1670. Those were observed by way of the erection by way of 1697 via principal John Han bury of a mill at Pont pool to roll 'Pont pool plates' - lower back plate. Later this commenced to be rerolled and tinned to make tinplate. A tandem mill is where the metallic is rolled in successive stands; Ford’s tandem mill became for hot rolling of cord rods. Rolling mills for lead seem to have exited through the past due seventeenth century. Copper and brass had been additionally rolled through the past due 18th century.

V. TYPES OF ROLL CHOCKS

Roll Chocks are used in different applications and depending upon the nature of the application, the roll chocks are broadly categorized into 4 types. These types of roll chocks are:

Work Roll Chocks

Back-up Roll Chocks

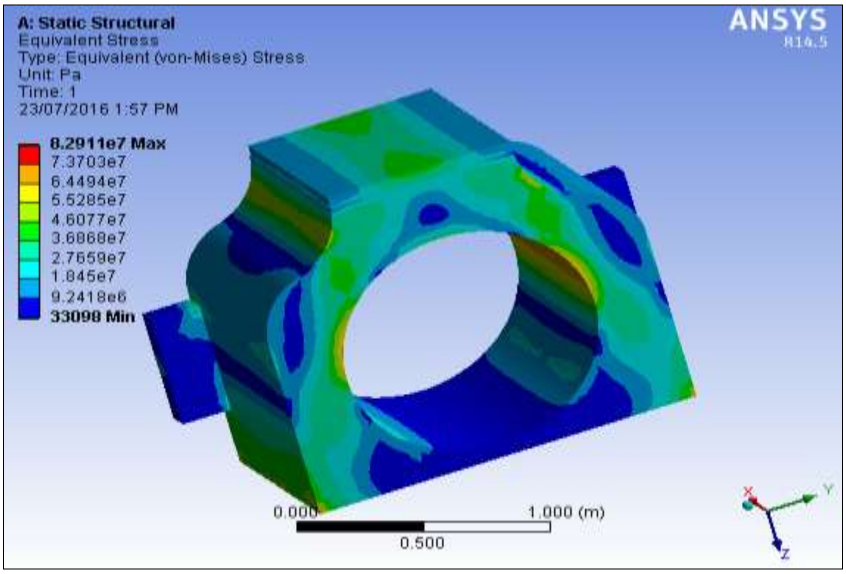
Upper Roll Chocks

Bottom Roll Chocks

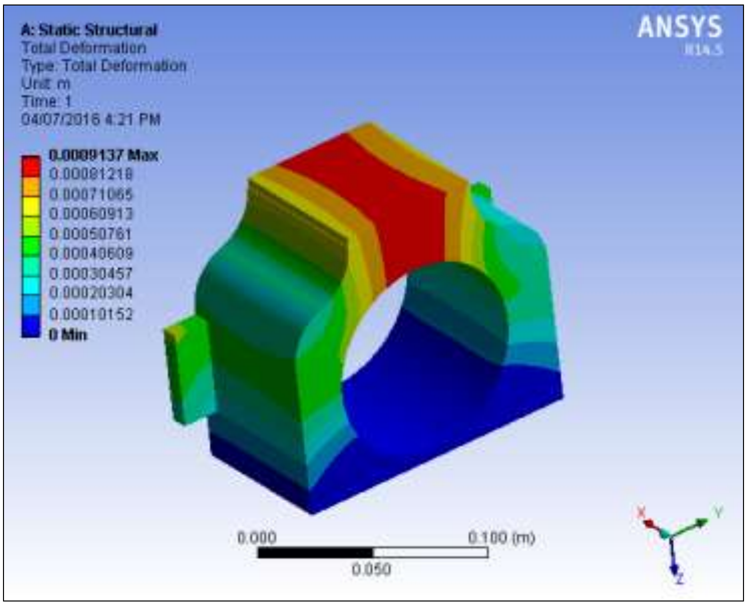
VI. ANALYSIS OF PROTOTYPE MODEL OF BOTTOM BACKUP ROLL CHOCK

For all chocks analysis is finished and the analysis of all chocks is tabulated for the further conclusions. Three substances and three trials have taken for the analysis of chocks. Following ansys images shows the stresses and deformation inside the Prototype model of a chock.

ANSYS RESULT



STRESSES IN BOTTOM BACKUP ROLL CHOCK



DEFORMATION AT 2100 KN

VII. EXPERIMENTAL SETUP

Software evaluation highlighted the bottom again Up Roll Chock with material EN 31 is the only in which the deflection is maximum up to 1.1% and Mass reduction allowed up to 24. 57%, as a result bottom again Up Roll Chock is selected for the experimental evaluation. A prototype version of scale 10:1 is manufactured with material EN 31 and used for the Experimental installation.

7.1 Experimental Set Up for Testing Scaled Model of Rolling Mill Chock

The main components of set up are,

1] Prototype model of Backup roll chock:

Prototype model is made of material EN 31; the dimensions are maintained so that the ratio will maintain as 10:1 in actual component to prototype model.

2] Universal Testing Machine (UTM):

UTM is used to create simulations for the testing set up.

Original model of Bottom Back Up Roll Chock of existing material is of Fe410 and Scaled Prototype model of Bottom Back Up Roll Chock of scale 10:1 of material is of EN 31. Prototype model of Bottom Back up Roll Chock of material EN 31 is tested on Universal Testing Machine by applying loads of 900 KN and 2100 KN.

Fig. Experimental set up- Universal Testing Machine

The Graph obtained by applying load of 2100 KN is shown below:

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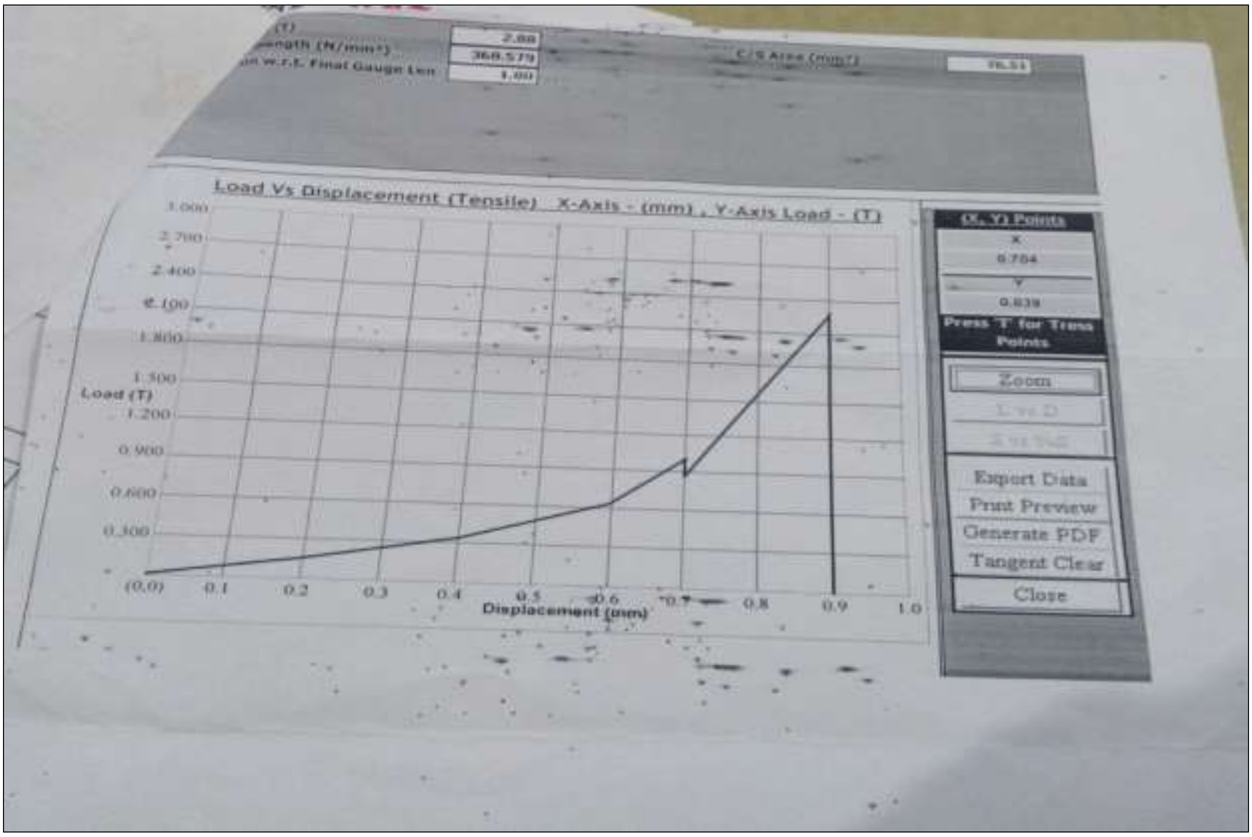

FROM GRAPH WE CAN CONCLUDE THAT FOR THE LOAD OF 2100 KN ,THE DEFORMATION IS 0.87 MM

VIII. RESULT TABLE

Sr. No	Load in KN	Deformation Result		Variation
		Experimental	Ansys	
1	900	0.67	0.7 mm	4.2%
2	2100	0.87	0.91	4.3%

IX. CONCLUSION

Finite element analysis is a science that's used to calculate displacements (Deflections), stresses in components beneath the hundreds performing on it. The consequences of Finite element evaluation are utilized in conceptual research of recent designs, product development and optimization of products.

For evaluation and optimization, roll chock of cold rolling mill have selected. computer aided simulation of a Roll chock is a novel idea to save the material without hampering the strength of the chock, via analysis of the real chock model on ANSYS (FEA software). Structural evaluation is completed with current chock material Fe410 and proposed material EN08 and EN31, with distinct dimensions as first and 2d changes, material EN31 with 2d dimensional change located suitable for the optimization of rolling chocks.

UTM is used for the simulation of forces to load the chock. The optimized chock could result into utilization of less material as much as 24.57%, and might have sufficient energy compared to existing chocks, with growth of deflection up to at least one.1%. So it can be conclude that the layout of roll chocks is optimized. It's far monitor that there is a scope for optimization of chock.

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