A Review Paper on Stress Analysis of Rolling Mill Roller

Dr. S. K. Sonpimple[1] Dr. G. D. Mehta[2] Snehal S. Thengane[3]
[1,2]Assistant Professor [3]PG Research Scholar
[1,2,3]Department of Mechanical Engineering
[1,2,3]Priyadarshini College of Engineering, Nagpur, MH- India

Abstract— Nowadays the industry is facing one of the basic problems that is failure and breakage of rolls in rolling mills. Roll breakage and cracks on its surface occurs due to overdraft or due to multiple passes which increases stress on a particular area. The forces and work load on the portion where the rolls comes in contact with the rolling surface can be found out. By combining numerical Finite Element Analysis methods (FEA) with analytical solutions, a rapid, accurate, flexible, model useful for optimizing many important rolling parameters can be designed. This model will give the stress patterns due to application of various loads and temperature. We are using ANSYS software to calculate stress-strain state of roller mill. The papers we are referring for the proposed work are given in this study.

Key words: ANSYS, Finite Element, Rolling Mill

I. INTRODUCTION

Rolling is a process of metal forming where the material or a slab passes through a pair of rolls. Compared with the other methods of metal forming such as forging, extrusion, drawing and other processes, rolling has more wide application in high productivity, variety. Rolling is one of the processes of metal working in which changes the dimension and shape of metal work piece are produced with the application of pressure by contact with cylindrical rolls. There are two types of rolling processes hot rolling and cold rolling. If the temperature range is above the re-crystallization temperature of material then the process is hot rolling. If it is below re-crystallization temperature then the process is known as cold rolling.

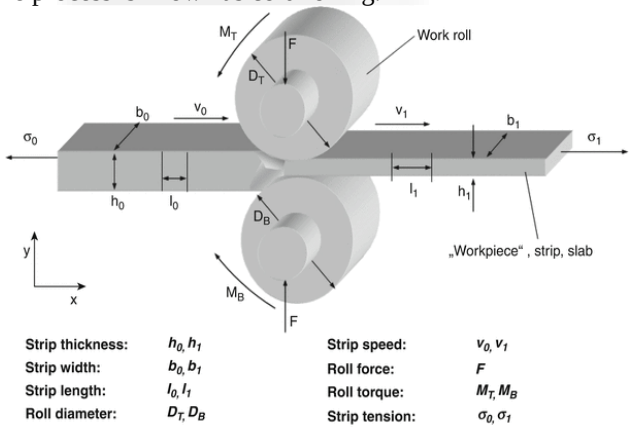

Fig. 1: Rolling Process

Hot strip mills have experienced major progress over the last few years thanks to the improvement of product quality and advances in rolling mill productivity. Rolling mill rolls play an essential role in achieving such quality and productivity levels. As a consequence, rolls for hot strip mills have been changed with the introduction of continued materials improvements and development of new materials. Knowledge of materials, actual rolling conditions and roll failure mechanisms are necessary to improve the wear resistance and extend the roll life.

II. LITERATURE REVIEW

HONJO Hisashi, et al [1], "Rolling Technology for Thin Steel Strip in Hot Strip Mill Train", has analytically examined mainly the metallurgical microstructure and other rolling characteristics in hot rolling for thin steel strips. The characteristics were theoretically calculated and analyzed on a compact hot mill train producing ordinary steel strip with 1.2 mm final thickness.

A. K. RAY, et al [2], "Failure analysis of rolls of cold rolling mill in steel plant", studied that the work rolls used in the cold rolling mills are expected to perform under very heavy loading conditions. The objective was to analyze the reasons of failure from manufacturing as well as operational point of view and to provide suitable recommendations for extending the life of a cold rolling tandem mill work roll. Samples of prematurely failed rolls from indigenous as well as imported make were collected for examination at NML.

Jian-guo CAO, et al [3], "Finite element analysis of strip and rolling mills", Finite element method is a method used to design and simulate any particular object. In this paper the analysis on rolling mill is done to find out the mechanical, thermal, deformation and other behavioral properties. The developed hot strip mill and tandem cold rolling mill which provide both wear control and profile control ability and gain better strip profile and flatness quality, process improvements and productivity increase.

Rajinder Singh [4], "Load Analysis of Rolls in a Rolling Mill: A Comparison of Robert's Formulation with the Experimental Method", says that failure and breakage of rolls in rolling mills is one of the basic problems that the industry is facing. It causes due to multiple passes and overdraft which may result in higher stress generation on the rolls. In this paper experimentation was carried out with the help of strain gauges and strain indicator. The results were compared with the loads acting on the roll from the theoretical formulation provided by W. L. Roberts.

Shuixuan Chen, et al [5], "Calculation of rolling pressure distribution and force based On improved Karman equation for hot strip mill" An improved Karman equation for hot-rolled strip was deduced to generate a new rolling pressure formula, based on comprehensive consideration of the slipping and sticking friction on the contact arc between hot-rolled strip and work rolls. The Runge–Kutta method was applied to solve the improved differential equation, and then the distribution of rolling pressure on the contact arc was obtained.

Licheng Yang, et al [6], "Effect of process parameters on mechanical behavior in hot-slab rolling" Based on thermo-mechanical coupled FEM; a mathematical model has been developed to predict flow stress, rolling force, contact normal force and friction force during hot continuous rolling process. The simulation results were

found to be in good agreement with the reported results in the theoretical analysis and experiment measurements.

Mahdi Bagheripoor & Hosein Bisadi [7], "An investigation on the roll force and torque fluctuations during hot strip rolling process", A mathematical model has been developed to simulate hot rolling of aluminum strips. A precision analysis of the roll force and torque and their fluctuations during the rolling process is the major innovation of this work. The effects of process parameters such as rolling speed and strip reduction are considered. The performance of the model was proved with a reasonable accuracy by comparing the model predictions with the experimental data.

III. Conclusion

These papers were studied to find out the load and temperature fluctuations during rolling process, to find out the pressure and thermal stresses developed during the process of rolling.

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