Analysis and Optimization of Powered Roller Conveyor using FEA

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Abstract— The Aim Of Paper Is Analysis And Optimization Of Powered Roller Conveyor By Using Fea & Validate Same By Concern Industry. Paper Also Involves Geometrical And Finite Element Modeling Of Existing Design. Geometrical Model Was Done By Using Catia /Solid Works.
Key words: Powered Roller, Catia, Solid Work, ANSYS

I. INTRODUCTION

Powered roller conveyor is used in many industries including automotive industry. A conveyor system is a common piece of mechanical handling equipment that moves materials from one location to another. Conveyors are especially useful in applications involving the transportation of heavy or bulky materials. Conveyor systems allow quick and efficient transportation for a wide variety of materials, which make them very popular in the material handling and packaging industries. Many kinds of conveying systems are available, and are used according to the various needs of different industries. There are chain conveyors (floor and overhead) as well. Chain conveyors consist of enclosed tracks, I-Beam, towline, power & free, and hand pushed trolleys. Conveyor systems are used widespread across a range of industries due to the numerous benefits they provide.

In discussion with Om Sai Enterprise, existing powered roller conveyor failed in the running conditions when moving load on roller is changed. Due to change in load failure of roller is observed, which affects production. This work is under taken to do Analysis and optimization of Powered roller Conveyor using FEA for solving above Problem.

II. PROBLEM DEFINITION

In discussion with industry we came across problem, existing powered roller conveyor failed in the running conditions when moving load on roller is changed. . Due to change in load failure of roller is observed, which affects production.

III. SPECIFICATION OF CURRENT POWER ROLLER CONVEYOR

1) Length of one roller conveyor: 2250 mm
2) Width of roller conveyor: 666 mm
3) Outer Roller dia.: 60 mm
4) Inner Roller dia.: 44 mm
5) Roller thickness: 08 mm
6) 6. Roller length : 560 mm

IV. OBJECTIVE OF THE STUDY

1) Study existing Power roller conveyor system and its Design.
2) Geometric modeling of existing Power roller conveyor.
3) To carry out linear static analysis, optimization of existing roller conveyor by using ANSYS.
4) To carry out Analysis of Modified design for same loading condition.
5) Recommendation of optimized new solution.

V. LITERATURE REVIEW

S. M. Shinde [1]The aim of this paper is to study existing conveyor system and optimize the critical parts like Roller, C-channels for chassis and support, to minimize the overall weight of assembly and material saving. Paper also involves geometrical and finite element modeling of existing design and optimized design. Geometrical modeling was done using Catia V5R19 and finite modeling was done. Results of Linear static, Modal and Transient analysis of existing design and optimized design are compared to prove design is safe. Optimization gives optimum design for same loading condition with huge amount of weight reduction. Using this procedure and using practical available structure 30.931% weight reduction is achieved.

Prayag. R. Shirolkar [2] In general, Roller Conveyors are designed with a set of elements to reduce cost, ease of assembly and manufacturability etc. In context to this, one also needs to address stress issues at the contact regions between any two elements; stress is induced when a load is applied to two elastic solids in contact. If not considered and addressed adequately, these stresses can cause serious flaws within the mechanical design and the end product may fail to qualify. The application of Hertizian contact stress equations can estimate maximum stress produced and ways to ease the stresses can be sought. In many cases, the resultant stresses are not of design significance, but in some cases failure can occur. The roller bearing assembly and spur gear pair assembly is an example where the assembly undergoes fatigue failure due to contact stresses. In this study, Roller conveyor conveying huge loads over varying lengths is considered. The pallet along with the load rolls over the rollers making a line contact in between. High stresses are generated in this case as the total load acts through this line of contact. A contact patch is generated at this line of contact. With CATIA, the parametric modeling at the interface of the roller and pallet is carried out. In the development phase, the contact stress analysis is carried out. The finite element analysis software ANSYS Workbench was used for this purpose. Results such as maximum contact pressure, maximum shear stress, and maximum principal stress are determined. A true assessment of the contact region is made so as to predict the behavior at extreme conditions. Finally, conclusions are drawn based on the theoretical and analytical results.

Gaikwad S.S [3] In the present work, an attempt is made to reduction in weight of existing roller conveyor by optimizing the critical parts of (e.g. C-channel,) conveyor without hampering its structural strength. This is the weight of the largest component to be transported over the conveyor. The conveyor would normally encounter gradually applied loads while the components are lowered

by hoist. For reasons of safety, a `sudden load' is already considered during its design phase. Transient analysis of existing conveyor is carried out find out maximum deflection & stress.

Then Optimization is carried out by modifying the dimensions of C-channel for chassis .Then analysis of optimized design are carried out to find out maximum deflection & stress. As such, the existing roller conveyor structure is tested for mechanical strength over the shop-floor while a trial is taken using optimized designed rollers of assembly and with the real-time components of the excavator.

Mr. Rajratna A [4] one of the major equipment in material handling is roller conveyor. As the roller conveyors are not generally subjected to complex state of stress they can be designed by providing higher factor of safety it leads to unnecessarily increase in material cost. This can be reduced effectively by separately designing conveyor part and testing whole assembly for transient and mode shape analysis for critical parts.

Mr.Amol B.Kharage [5] The main objective of this study is to explore the analysis of Gravity roller conveyor. These has entailed performing a detailed Study of existing Gravity Roller Conveyor system and optimize the critical part like roller, C-channel etc. by using composite material, so to minimize the overall weight of the assembly without hampering its structural strength. A proper Finite Element Model is developed using Cad software Pro/E Wildfire 5. Results of Static, Modal and Transient analysis of existing design and optimized design are compared. The material used for roller and C-channel frame is a composite material i.e. carbon fiber.

G.Velmurugan [6] The main damages are occurring in bulk material handling system due to the sticking of the material which is transporting and the damages due to the chemical reaction and also there causes failure due to carry back of product. The problems and failures need a permanent maintenance. The removal of sticking materials can be done by two methods, by using a wire brush which is placing under the conveyor belt; it will remove the sticking materials when the conveyor rotates. There is one more solution for this is problem to use a water spray under the belt conveyor belt for the sticky materials.

Pawar Jyotsna [7] The aim of this paper is to study existing Belt conveyor system and optimize the critical parts like Roller, L channels and support, to minimize the overall weight of assembly. Paper also involves geometrical and finite element modeling of existing design and optimized design. Geometrical modeling was done using Catia V5R20 and finite modeling done in ANSYS14.0. Results of Linear static, Modal and Transient analysis of existing design and optimized design are compared to prove design is safe. In this paper we work on the roller design and optimization.

Quanwei Wang[8] This paper builds a three-dimensional solid model by Solid works for study of a large belt conveyor drive roller. The quality of the roller optimized by the zero order algorithms and the optimization target is minimizing quality. Modal analysis of the conveyor roller is carried out in two different cases by ANSYS. Finally, it obtains the intrinsic frequency and mode shapes of the belt conveyor drive roller. The purpose is to provide a basis for the further static structure analysis and design of the roller

Brown, S.C [9] Large, outdoor Belt Conveyor Systems for bulk materials are major sources of industrial noise and frequently become an environmental emissions issue for many existing and proposed +++plants. Deficiencies in the industry's understanding of the complex, underlying conveyor noise generating mechanisms has meant there are relatively few practical and cost-effective noise management strategies. On the other hand, pressure from regulators and the community generally has frequently led to unachievable conveyor noise specifications. This paper presents the results of an innovative program of research and testing of conveyors and conveyor components. Conveyor noise is shown to be a composite of noise generating mechanisms, the most dominant of which is the dynamic interaction at the belt/idler roll interface. The Idler Roll surface profile is shown to be a major input to excitation of vibration and noise radiation for most conveyors. An idler roll surface profile measurement parameter is proposed - the Maximum Instantaneous Slope, (MIS) - which can be used to evaluate and assess the operating condition and noise generation potential of existing equipment, as well as to provide a practical basis for specification of new conveyor systems.

Suhas M. Shinde [10] over the years a lot of work has done and is still continuing with great effort to save weight and cost of applications. The current trend is to provide weight/cost effective products which meet the stringent requirements. The aim of this paper is to study existing conveyor system and optimize the critical parts like roller, shafts, C-channels for chassis and support, to minimize the overall weight of assembly and material saving.

Memane Vijay S[11] The aim of this paper is to study existing Belt conveyor system and optimize the critical parts like Roller, L channels and support, to minimize the overall weight of assembly. Paper also involves geometrical and finite element modeling of existing design and optimized design. Geometrical modeling was done using Catia V5R20 and finite modeling done in ANSYS14.0. Results of Linear static, Modal and Transient analysis of existing design and optimized design are compared to prove design is safe. In this paper we work on the roller design and optimization.

VI. PROPOSED FLOW OF WORK & METHODOLOGY

1) Study of present power roller of conveyor.
2) Problem Identification
3) Failure Analysis on existing power roller by analytical Method.
4) Conceptual re design of power roller using input &
5) Modeling in SOLIDWORKS or CATIA
6) Analyze model by using ANSYS & select best from available.
7) Material Optimization by using ANSIS 14.5.
8) Analysis for different materials.
9) Results

VII. CONCLUSION

From the above theoretical study we can conclude that powered roller is major part of conveyor system. We are tried to reduce the excessive deformation in powered roller and also attaining for optimization of the power roller.

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